AN INVESTIGATION INTO THE IMPACT OF CULTURE ON CONSTRUCTION PROJECT PERFORMANCE

by

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This work or any part thereof has not previously been submitted in any form to the University or to any other body whether for the purpose of assessment, publication or for any other purpose. Save for any express acknowledgements, references and/or bibliographies cited in the work, I confirm that the intellectual content of the work is the result of my own efforts and no other person.

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Abstract

For many years, government backed reports have continued to deplore the poor performance of the construction industry with many projects failing to exceed or live up to the expectations of clients. There is a common belief that the culture of the construction industry is one of the factors that has an impact on its performance. The culture of the construction industry at the project level is often associated with such attributes as fragmentation, antagonism, mistrust, poor communication, short-term mentality, blame culture, casual approaches to recruitment, machismo and sexism. These attributes are in turn associated with project outcomes like litigation, poor health and safety performance, and inferior quality. Whilst such associations are helpful to the extent that they focus attention on the failings of the industry, and point to aspects that need to be improved, they are arbitrary and often based on no more than anecdotal evidence, and as such do not provide a systematic basis for assessing the real impact of culture on performance. This research was thus undertaken to look for empirical evidence of a relationship between cultural orientations and project performance outcomes.

Adopting social cognitive theory and defining culture as the unique configuration of solutions – embodied in attitudes, behaviours and conditions – that a construction project organisation and its members adopt in dealing with problems at the project level, a quantitative research methodology was employed in investigating the culture within the project coalition, also referred to in this thesis as the construction project organisation (CPO). CPOs were profiled to determine their cultural orientations. Several project performance indicators were also assessed and the relationships between these performance measures and the cultural orientations were examined. Analysis revealed five principal dimensions of culture along which project organisations differ. These dimensions are *workforce orientation*, *performance orientation*, *team orientation*, *client orientation* and *project orientation*. With the exception of performance and client orientation, the other dimensions of culture were found to be significantly associated with project performance outcomes. These associations were modelled using multiple regression, and from these models it can be inferred *inter alia* that projects with higher workforce orientation have better participant satisfaction and innovation and learning outcomes. Projects with higher team orientation have better participant satisfaction and health & safety and quality outcomes. Likewise projects with higher project orientation have better health & safety and quality outcomes.

Although causality cannot be assumed, these findings support the thesis that culture matters. It is therefore recommended that project participants – and in particular contractors, devote more effort and resources towards improving the orientations of their CPOs in respect of the dimensions of culture identified as having significant association with project performance outcomes, particularly workforce, team and project orientations.

Dedication

This thesis is dedicated to my wife, Akosua for her love and support and to my whole family.

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I am grateful to my Director of Studies, Prof. David Proverbs whose excellent guidance, encouragement and patience has led to the successful completion of this research.

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CHAPTER 1: INTRODUCTION

1.0 INTRODUCTION

In undertaking any research, it is necessary to initially establish the need for such a study and to clearly set out the intentions of the research. By so doing, a point of reference is provided against which the outcomes of the research can be assessed. This is the intention of this chapter in which the research context is set, and the aim and objectives are defined. A brief discussion of the scope of the research, research methodology and main contribution to knowledge of the study is also presented followed by an outline of the way the thesis is structured.

1.1 RESEARCH BACKGROUND

UK construction industry reports since the Simon report of 1944 have continued to deplore the poor performance of the construction industry with many projects failing to exceed or even live up to the expectations of clients. As a result, performance improvement has remained a recurring theme in all the major reports including Sir John Egan's landmark 'Rethinking Construction' report (Egan, 1998). For this improvement in project performance to be achieved, it is essential to investigate the factors that cause poor project performance.

Studies conducted in this field so far have focused mainly on the influence of such factors as procurement routes, management systems and techniques, and construction methods (e.g. Larson, 1997; Proverbs *et al.*, 1999). Beyond these, it has been suggested, mainly on the basis of anecdotal evidence, that 'softer' factors such as *organisational culture* also have a significant impact on performance by virtue of the influence they have on the way participants approach work. Unfortunately, notice given to the issue of organisational culture by the construction industry can at best be described as marginal, and most of the discussion has been discursive. Systematic research into organisational culture has been rather limited (Hall, 1999; Ankrah and Proverbs, 2004; Dainty *et al.*, 2007), with culture just being utilised as a "black box" reason for most of the industry's ills for which other reasons cannot be adduced (Fellows and Seymour, 2002).

Over the past two decades however, culture has emerged as an important issue in construction and there has been a growing research interest into this 'soft' area which is critical to the management of construction businesses and projects, particularly with the increasing internationalisation of procurement. At the project and organisational level there have been studies looking at such issues as 'project chemistry' (Nicolini, 2002), harmony (Lui, 2002), and comparisons between organisational cultures of contractors and consultants (e.g. Rameezdeen and Gunarathna, 2003; Ankrah and Langford, 2005). At the national level, attention has focused on the effects of culture on transfer and implementation of management philosophies (Ngowi, 2000) and international project management (Hall, 1999; Low and Shi, 2001) among others. All these studies demonstrate a growing awareness in the construction industry of the critical part 'softer' issues like culture play in project performance outcomes. This awareness notwithstanding, the nature of the implied relationship between organisational culture and performance still remains unclear since few studies exist that provide empirical evidence of this. As a result, it has not been possible to definitively identify cultural orientations that influence the process of delivering the products of the construction industry with its peculiar characteristics, and to strongly advocate and build those cultural orientations that improve performance whilst taking steps to mitigate the effects of those orientations that are incompatible with good performance. There are many fundamental questions which still remain unanswered or at best have only been addressed piecemeal. For instance what is the culture on the construction project, and does such a thing as 'culture' even exist? Is there any evidence that on different projects different cultural orientations exist, and if they do, do they lead to significantly different performance outcomes? Should culture be considered as something that the temporary project coalition *is* and therefore not easily changed, or as something that the project coalition *has* (Smirchich, 1983) that can be manipulated to bring about change in orientation and performance outcomes?

These are fundamental questions that need to be addressed through research. An appreciation of how culture, in whatever form, affects the profitability and performance of construction projects will help with the process of implementing changes in culture and organisational structures. Such research is however generally lacking as noted by Hall (1999), therefore studies exploring such relationships will undoubtedly be beneficial to the construction industry.

Xiao and Proverbs (2003) pointed out that the overall performance improvement agenda of the construction industry requires improvements in products (right first time), the delivery (in terms of quality, cost and time), and the sustainable development of construction firms (profitability and competitiveness). To the extent that culture, as will be demonstrated in the subsequent chapters, potentially has a significant influence on all these elements and by extension the performance of construction organisations and the industry as a whole, it merits systematic research to explore the nature and extent of such influence.

It is against this backdrop that this research project is being undertaken with research hypotheses designed to provide answers about the extent to which organisational culture varies with projects, and the effects that these various cultures have on project outcomes. These answers will help bridge the clearly identified gaps in knowledge that have informed this investigation, relating for instance to the existence or otherwise of differences in cultural orientations on construction projects, and if the existence of such differences lead to significantly different performance outcomes. Such an empirical study of the relationship between organisational culture and project performance will provide a significant contribution to the body of knowledge on culture in construction and project performance.

1.2 AIM AND OBJECTIVES

The principal aim of this research is to determine empirically the extent to which organisational culture influences construction project performance and the nature of this influence, and to develop a model (or models) that will assist construction project organisations to assess, in terms of performance, the possible outcomes of their cultural orientation.

To achieve this, the study would seek to:

1. Critically review literature on performance to develop an understanding of the factors influencing project performance and the role of culture;
2. Trace the definition and evolution of the construct of 'culture' with particular emphasis on organisational culture;
3. Develop a conceptual model of the relationship between organisational culture and performance;
4. Develop an instrument for measuring and diagnosing the organisational cultures of project organisations, and also for measuring the performance of project organisations;
5. Assess project organisations to establish their specific cultural orientations and levels of performance;

6. Explore empirically the possible relationships between each specific cultural attribute and the performance of the project organisations; and
7. Develop a model (or models) that relates organisational culture with performance and helps identify cultural attributes that are significantly associated with an improved construction project performance.

1.3 SCOPE OF STUDY

In pursuing this research the focus of attention is on the temporary project coalition engaged to deliver a construction project and the construction project itself. The construction project is thus the unit of analysis. Thus the research covers both private and public sector work, civil engineering and building projects, as well as the different types of facilities (e.g. commercial or educational). The study focuses on construction projects within and across the UK to ensure that potential variations due to the national context are controlled for and kept uniform as much as possible, and to ensure that findings reflect the general trend across the UK.

1.4 METHODOLOGY

The research methodology for this study is to a large extent positivist (quantitative), which implies that the research process is largely deductive. Within this general positivist framework, elements of the phenomenological (qualitative) approach are also incorporated to provide alternative insight into the phenomenon of culture from a practitioner perspective. Starting with basic observations and theoretical insights derived from literature, conceptual models and research hypotheses are developed and tested with the progress of the research. Research methods applied include a literature survey, with the primary data collected through interviews and questionnaire surveys.

The study commences with an in-depth literature review focusing on the areas of performance, organisational culture and its measurement, and the performance criteria and measurement frameworks for construction projects in the UK. This forms the basis for the development of a conceptual model of the relationship between culture and performance. This framework is refined by in-depth semi-structured interviews, and followed by a UK-wide questionnaire survey of contractors and other project management personnel to collect data on specific cultural attributes and performance.

Data analysis is undertaken using descriptive statistics at the preliminary stages to provide useful insights, with more detailed analysis done using factor analysis, ANOVA, correlation analysis, and other statistical tests of significance. Appropriate statistical analysis software are employed, where necessary, to aid analysis. Using a suitable modelling technique in the form of multiple regression analysis, comprehensive model(s) depicting the nature and extent to which organisational culture influences construction project performance are developed. These models then form the basis for identifying cultural attributes suited to the peculiar nature of construction projects.

The entire process can be summarised as shown below in Figure 1.1.

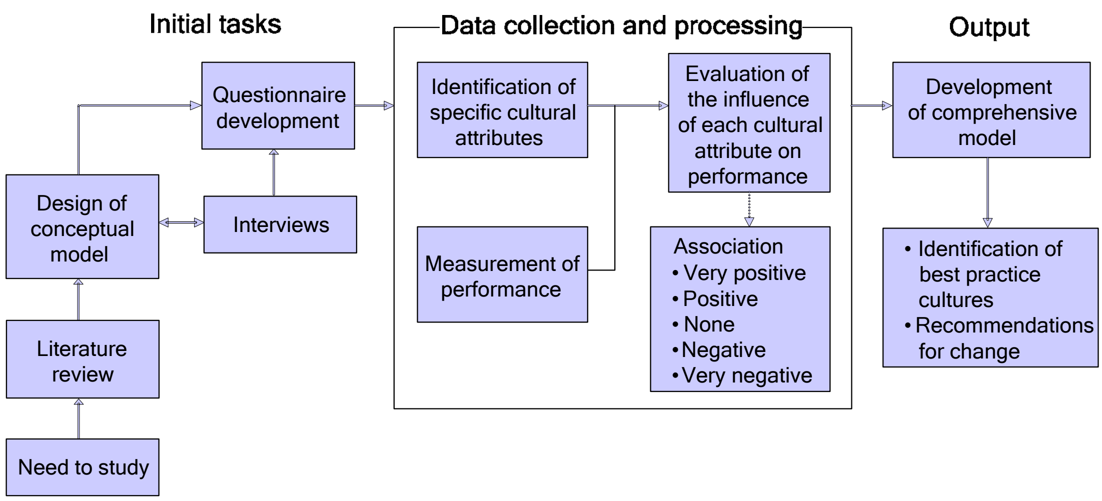

Figure 1.1 The research process [Adapted from Serpell and Rodriguez (2002)]

1.5 CONTRIBUTION TO KNOWLEDGE

Building on the existing knowledge on organisational culture, this research has provided greater insight into organisational culture within a construction project context, in particular providing empirical evidence that different project teams have different cultural orientations and that these different cultural orientations are associated with different levels of performance. It has also demonstrated that workforce, team and project orientations are the specific dimensions of culture which have the most association with project performance outcomes and as such are the dimensions that require the attention and resources of the organisations involved in the project. Four (4) statistical models have also been developed to represent the relationships between the cultural orientations and performance outcomes, and though their predictive utility is limited, these models do provide some guidance on the likely project performance outcomes given a specific cultural orientation. This implies that project teams can undertake an assessment of their cultural orientations and based on that, forecast the probable project performance. Where necessary, action can then be taken to improve the cultural orientation.

By empirically associating various cultural orientations with project performance outcomes, this research has provided evidence that culture does matter in the quest for performance improvement on construction projects. The findings can thus be used as a basis for recommending or encouraging cultural change in construction organisations. It can also be used as a basis for encouraging researchers of project performance to devote more attention to the 'softer' aspects such as culture.

Beyond the direct output of the research discussed above, the research has also made significant contribution by moving the discussion of organisational culture within the construction research context from the traditional 'black box' approach towards more empirically grounded discourse.

As a result of the research undertaken, ten (10) technical papers have been published (or will soon be) in refereed international construction journals and conference proceedings. Full bibliographic details are provided in Appendix A. Several more are under development.

1.6 STRUCTURE OF THESIS

The thesis consists of ten (10) chapters, organised as shown in Figure 1.2. Chapter 1 outlines the context within which the research is undertaken, and sets out the aim and objectives. The scope and the research methodology applied are also briefly outlined, and then the main contributions of the research to knowledge are presented.

Chapter 2 presents a review of the literature focusing on the structure and profile of the UK construction industry, the project delivery process, the performance of the UK construction industry, and the factors influencing performance. In particular, this chapter seeks to highlight the performance deficit that still exists in the UK construction industry, and the lack of emphasis and research on the role of 'softer' factors like the culture within the project organisation, on the quest for performance improvement.

Chapter 3 continues the review of literature but focuses on the concept of culture, the role that it plays in determining organisational outcomes, and the theories underpinning its conceptualisation and investigation. The chapter also interrogates literature within the construction domain on research undertaken in this genre with the aim being to establish how it is conceived in construction management research, the extent to which it has actually been researched in construction, and the scope that still exists for further research. In particular, this chapter seeks to draw attention to the paucity of empirical research on culture and its impact on project performance.

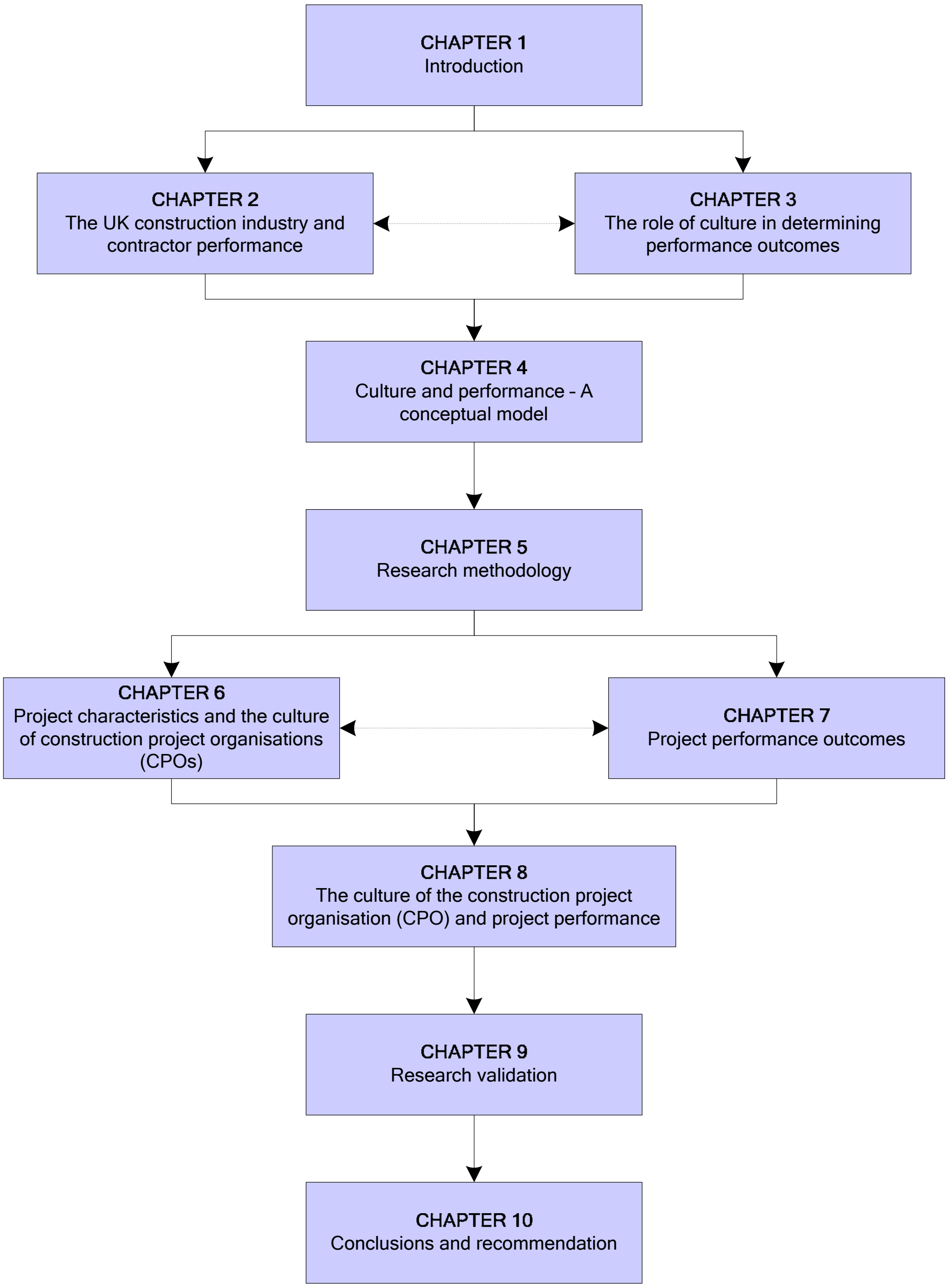

Figure 1.2 Organisation of the thesis

In order to investigate systematically this empirical relationship between culture and performance, it is necessary to have a conceptual framework that brings together in a logical manner all the essential aspects to be investigated, and provides appropriate parameters and points of reference for investigating culture within a construction project context. In Chapter 4, the discussion addresses the development of a conceptual model which is intended to aid the identification of appropriate hypotheses, data collection and hypotheses testing.

In Chapter 5, an outline of the research methodology adopted for undertaking this research is presented; in this case a quantitative research methodology, with aspects of the qualitative approach incorporated to support and improve the research design. Arguments are presented justifying this choice of a conciliatory approach and the specific research methods applied to collect data. The data collection process is detailed in this chapter.

Chapter 6 presents the first part of the data analysis, with discussions outlining the characteristics of the projects surveyed to set the context within which the project organisations had operated. The purpose of this analysis is to make it possible to specify the kind of projects for which the inferences drawn from this research are applicable. The chapter also presents an analysis of the data on the cultural orientations of these project organisations and gives an overview of the general cultural profile of project organisations working within the UK. Further evaluation to identify differences in the cultural orientations of the project organisations is also presented. The relationships between project features and the cultural orientations within the sample are also examined, and inferences are drawn.

In order to evaluate the impact of cultural orientations on project performance outcomes, it is necessary to assess the performance of construction projects in the UK, where performance is the degree to which the project objectives are achieved. The performance of the construction projects as assessed on the basis of the various outcomes pursued by stakeholders including *inter alia* cost, time, quality, health and safety, disputes, and productivity outcomes, is discussed in Chapter 7.

Chapter 8 explores the potential relationships between the operating cultures within the project organisations and the project performance outcomes to determine whether or not any significant associations exist. Models of the relationships are developed and presented in this chapter to help identify orientations that are associated with better performance outcomes.

The extent to which the findings reported in a research study can be trusted relies on the process of validation undertaken to confirm (or disconfirm) the findings of the research. Chapter 9 is thus devoted to the description of the validation process that was undertaken in respect of this research, and the conclusions drawn from the findings.

After summarising the entire research, Chapter 10 – the final chapter, outlines the main findings of the research. A critical reflection of the entire research process, highlighting the limitations of the research and aspects where there is potential for improvement, is provided. The chapter concludes with some recommendations for construction industry practitioners, and some recommendations for future research.

1.7 SUMMARY

The performance of the construction industry has been berated consistently over the years and a lot of effort through initiatives like the Constructing Excellence programme and through extensive research, has been devoted towards engendering performance improvement on construction projects. Although there is a strong perception that 'softer' factors like culture also influence performance outcomes, a lot of the discussions about this subject have been discursive, and it is within this context that this research is being undertaken. This chapter has set out the aim and objectives of the study. The scope and the research methodology to be applied are briefly outlined, and then the main contributions of the research to knowledge are presented.

In line with the structure proposed for this thesis, the following chapter presents a review of the UK construction industry, pointing out the performance deficit, examining the factors influencing performance outcomes, and assessing the extent to which the role of culture is recognised in the performance literature.

CHAPTER 2: THE UK CONSTRUCTION INDUSTRY AND PROJECT PERFORMANCE

2.0 INTRODUCTION

The construction industry is significant in its contribution to the UK economy. The industry as a whole (together with all its associated services) contributes up to 10% of Gross Domestic Product (GDP)[1] (Pearce, 2003). This implies that its performance in delivering its products and services is important. In this chapter, the UK construction industry is profiled to assess its structure and performance. Various factors impacting on its performance as *per* the literature are also reviewed in a bid to establish whether or not the role of organisational culture in determining performance outcomes has been captured in project performance research. This review thus addresses the first key objective of this research which was to critically review literature on performance to develop an understanding of the factors influencing project performance.

2.1 A PROFILE OF THE UK CONSTRUCTION INDUSTRY

The UK construction industry is concerned primarily with the planning, regulation, design, manufacture, construction and maintenance of buildings and other structures (Harvey and Ashworth, 1997; ONS, 2002). In terms of size and structure, the industry can be viewed as having a narrow and a broad definition (Pearce, 2003). As shown in Figure 2.1 below, the narrow definition focuses attention on the actual on-site construction activities of

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[1] Gross Domestic Product (GDP) - Sum of all value added across all sectors in the economy (ONS, 2006).

contractors whilst the broad definition, which actually covers the true extent of the construction industry, draws in the quarrying of construction raw materials, manufacture of building materials, the sale of construction products, and the services provided by the various associated professionals (Pearce, 2003).

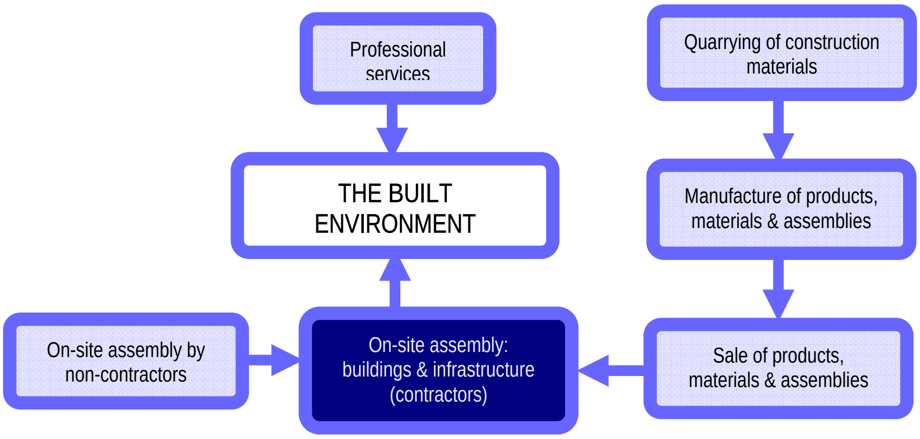

Figure 2.1 The composition of the construction industry [Adapted from Pearce (2003)]

Irrespective of the definition or where the emphasis is placed, the main aim of the construction industry is to deliver and maintain the built environment.

The built environment comprises housing, educational, industrial, commercial, and infrastructure facilities. Infrastructure is a generic term covering the provision of electricity, communications, water, sewerage, gas, air, railways, harbours, roads and the like (ONS, 2002). This definition of construction is based on the Department of Trade & Industry classifications (DTI, 2005), and also on the definition of the construction industry as per the Standard Industrial Classification (SIC) 45 category of the Office for National Statistics (ONS, 2002).

All these facilities may be either public work procured by a public authority such as government departments, public utilities, nationalised industries, universities, the Post Office, new town corporations, and housing associations, or private work procured by a private owner or organisation or by a private developer. Such private work includes work carried out by firms on their own initiative or where the private sector carries the majority of the risk (DTI, 2005). Work may also be classified as new work, repair and maintenance, or additions and alterations.

The industry's ability to deliver this built environment is influenced/moderated by a number of characteristics peculiar to construction including, as identified by Harvey and Ashworth (1997) and Fellows *et al.* (2002), the fact that:

- products have to be delivered at the client's premises;
- products tend to be physically large & expensive;
- production is exposed to the elements;
- usually there are no prototype models or precedents;
- design is separated from construction;
- there is fragmentation and extensive specialisation;
- there is risk and uncertainty;
- price determination is typically based on a system of bidding; and
- labour is often recruited casually.

These characteristics mean that the delivery of the built environment is project-based with the involvement of numerous participants whose responsibilities are set out in contracts. There is also limited control over the production environment. The risk and uncertainty associated with this method of production and method of price determination also means that margins are thin, uncertain and easily eroded, and considering the fact that an individual project can often represent a large proportion of the turnover of a participant in any year (Harvey and Ashworth, 1997; Fellows *et al*., 2002), there is inevitably mistrust among the participants because everyone is struggling to avoid making a loss, and as a result relationships are very often adversarial.

Notwithstanding these challenges, the UK construction industry is still economically very significant, and its contribution to the UK economy is examined in more detail below.

2.1.1 Structure and economic significance of the UK construction industry

In examining the structure of the construction industry, various indicators can be employed as the basis of analysis. Among these are number of firms, output and employment. As highlighted by Pearce (2003), each of these indicators reveals part of the story that is relevant to our understanding of the state of the construction industry. The distinction between the broad and narrow definitions becomes very significant when examining these indicators.

2.1.1.1 Number of firms

In terms of the number of firms, the construction industry has in excess of 350K firms in total, of which over 190K are contractors as per the narrow definition (Pearce, 2003). More current statistics published by the DTI for the construction industry also give 3rd Quarter figures of 176K private contractors in the UK for the year 2004 (DTI, 2005). The breakdown of this figure by the size of firm is shown in Table 2.1.

These 176K firms include the main trades comprising non-residential building, house building and civil engineering (about 46K firms), and the specialist trades including demolition, reinforced concrete specialists, asphalt and tar sprayers, scaffolding, painting, glazing, and so on which make up the remaining 130K firms (DTI, 2005).

Table 2.1 Number of firms by size [Source: DTI (2005)]

										3rd Quarter Each Year
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
By Size of Firm										
1	99,099	81,363	86,269	87,837	88,018	87,712	77,926	71,431	70,370	71,620
02-03	64,837	56,106	47,644	47,918	49,350	48,773	50,653	50,306	53,022	55,027
04-07	20,288	15,317	15,737	16,391	16,969	16,584	22,455	23,963	25,704	26,865
08-13	4,021	4,366	3,787	3,988	4,148	3,790	8,044	9,819	10,508	10,982
14-24	2,828	2,952	3,101	3,274	3,271	3,104	4,920	5,427	5,892	6,161
25-34	938	1,103	1,176	1,201	1,332	1,201	1,782	1,809	1,932	1,985
35-59	968	984	1,156	1,263	1,188	1,109	999	1,782	1,821	1,906
60-79	307	325	396	419	397	364	354	457	583	550
80-114	258	263	296	319	304	271	304	425	451	464
115-299	337	348	381	405	379	341	433	520	535	560
300-599	105	101	107	125	105	91	129	123	135	148
600-1,199	51	54	60	56	58	51	68	62	75	75
1,200 and Over	33	33	38	40	42	35	56	57	64	60
All Firms	194,070	163,315	160,148	163,236	165,561	163,426	168,123	166,181	171,092	176,403

Figure 2.2 below gives a revealing insight into the structure of the industry where over 87% of all firms are small, employing less than 7 persons, with almost half of these being one-person firms.

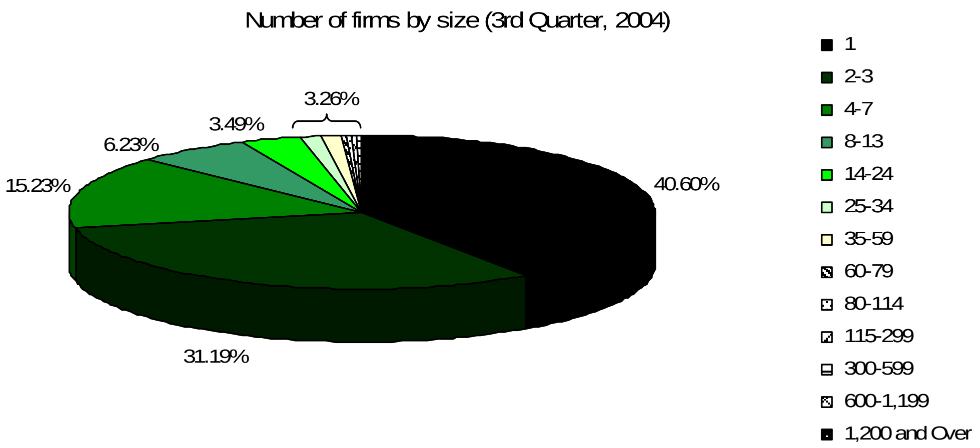

Figure 2.2 Number of firms by size (3rd Quarter, 2004)

2.1.1.2 Output

Another useful indicator of the economic significance of construction is the contribution to UK's Gross Domestic Product (GDP). Pearce (2003) estimated this to be about 5% as at 2002 for contractors (the narrow definition) and 10%

for the broader definition. Although no distinction is drawn between the narrow and broad definitions, the DTI also gives a contribution to GDP of about 8.2%, with value of construction output by all agencies[2] for 2005 given as £107B (DTI, 2006).

Surprisingly the 87% of contractors employing less than 7 persons account for just over 10% of all the construction output (DTI, 2005).

As indicated previously, construction output can be classified by sector (public or private), by type (new work or repair and maintenance) or by use (housing or non-housing). DTI data from 1994 to 2004 (DTI, 2005) shows that by value of work, the private sector accounts for up to 66.5% of output whilst the public sector accounts for 33.5%. These figures are comparable to Pearce's (2003) estimate of 31% public sector work in UK construction industry output and the more recent estimate of 40% public sector work by Sullivan (2006). New work accounts for about 53% whilst repair and maintenance (R&M) work accounts for about 47% (Fellows *et al.*, 2002; DTI, 2005). Housing currently constitutes about 40% of output.

2.1.1.3 Employment

As noted in a World Bank report on the wealth of nations, the output of any nation, or in the context of this study the construction industry, fundamentally depends on its human resources – i.e. "the skill, dexterity, and judgment of its labour" (World Bank, 1997). Although figures vary from source to source, it is estimated that between 1.4 – 2.0M people are employed in the UK construction industry. Pearce (2003) estimated that as at 2001, contractor employment was of the order of 1.7M, accounting for about 6% of total UK employment. Ive *et al.* (2004)and HSE (2006) also provide more current estimates of about 2M and 2.2M employees respectively, representing

[2] Output by contractors (including estimates of unrecorded output by small firms and self-employed workers) and output by public sector direct labour departments.

over 7% of the UK's total labour force (Ive *et al.*, 2004). Of this number, women are represented by only 9% and ethnic minorities by only 2 – 3% (CITB, 2002; DTI, 2005).

Clearly by all counts, the construction industry is highly significant in its size and structure. This is true even when considering only the narrow definition of the industry which is concerned with contractors and speculative housebuilders who construct, repair and maintain buildings or engineering works *in situ*. When this is juxtaposed against the fact that all other sectors depend on the output of the construction industry to undertake their activities, it becomes clear why good performance is required from the construction industry in the delivery of its products.

2.2 THE CONSTRUCTION PROCESS

The construction process starts with a client realising a need for a construction product (a constructed facility). Various participants then need to be engaged to contribute towards the realisation of this particular facility. Construction is thus a project-based activity (Fellows *et al.*, 2002). According to Turner (2006), a project is a temporary undertaking which involves the bringing together of various resources to achieve a specific short-term objective. Another formal definition provided by Hobday (2000) is that a project is any activity with a defined set of resources, goals and time limit. Newcombe (2003) defines a project as a coalition of powerful individuals and interest groups. This coalition is necessary because of the extensive fragmentation and specialisation within construction as pointed out earlier. This coalition, also referred to as a supply chain must be constituted to bring together the various specialisations, labour, capital and other resources required for the project. Given that organisations are generally groups of people cooperating and/or working together to achieve specific objectives which cannot be achieved by any single individual (Mullins, 2005), these construction supply chains can also be viewed as organisations, or more appropriately as a multiorganisation (Cherns and Bryant, 1984), and all the pre-requisites for effective functioning of an organisation apply, including a common objective and an appropriate organisational culture that is congruent with the environment (Thompson, 1993). Pant *et al.* (1996) referred to such a temporary undertaking created as a separate, autonomous unit for carrying out specific time-bounded activities as a project organisation. It therefore seems appropriate in this research to refer to such project organisations within construction as *construction project organisations* (CPOs). Within this research context therefore, the CPO is equivalent to what has been described by Cherns and Bryant (1984) as a *temporary multiorganisation* (TMO).

2.2.1 The Construction Project Organisation (CPO)

Key participants within this CPO or TMO typically include the Client, Consultants (an Architect and/or Civil Engineer, Quantity Surveyor, Structural Engineer, Mechanical and Electrical Engineer, and Project Manager depending on the type and scale of the project), Main Contractor, Subcontractors and Suppliers (Cherns and Bryant, 1984; Chua *et al.*, 1999; Soetanto *et al.*, 1999). The rules of engagement of the CPO are set out in contracts (Cherns and Bryant, 1984). These contracts not withstanding, the ability of the CPO to deliver a project successfully rests in the ability of participants to work together as a team towards a common objective. It is not uncommon to find participants pulling in different directions or working towards company objectives rather than project objectives. When the project is complete, the temporary multi-organisation coalition breaks up and the various participants go on to join other CPOs on new projects (*ibid*). The tendency therefore has been for participants to take a short-term view of projects and to focus more effort on trying to secure the next project rather than focus on the on-going project (Hsieh, 1998).

2.2.2 The Delivery Process

The delivery process itself occurs in a number of phases. The RIBA has set out the five key phases as *briefing, sketch plans, working drawings, site operations* and *feedback*. From a project management perspective, a more suitable classification of phases may be as set out in research like Lim and Mohamed (1999), Takim *et al.* (2003), and Ahadzie *et al.* (2006), with the six phases of *conception, planning, design, tender, construction,* and *operational phase* (Figure 2.3). These phases are also identified in Kwakye (1994), although in this case the *planning* phase is excluded, and a *contract documentation* phase is rather included.

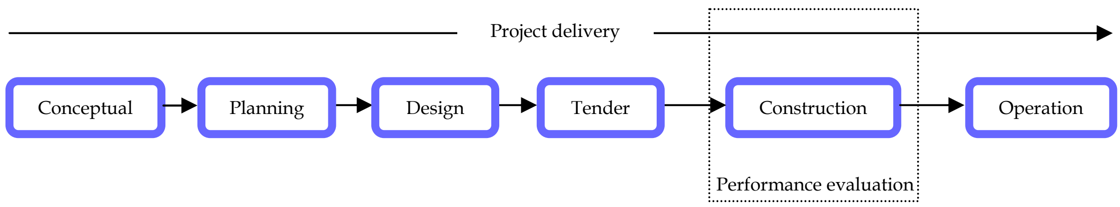

Figure 2.3 The process for delivering a construction project [Adapted from Lim and Mohamed (1999)]

Although the successful execution of the project in each of these phases is critical to the overall success of the project (Ahadzie *et al.*, 2006), very often in examining project success, the construction phase tends to be the focal point as indicated in Figure 2.3 above. This is because according to Lim and Mohamed (1999), the construction phase is the phase where all the project goals like time, cost, quality, safety and the like are put to the test. Whilst this may be true in many cases – certainly in the traditional approach – it is not always the case. In more recent times, the envelope for examining success has been extended to cover the pre-construction phases and the operational phases; a situation that can be attributed in part to such developments as whole-life costing, PFI and other modern ways of approaching project delivery. Generally however, the construction phase still remains the key phase for examining performance outcomes as reflected in many discussions on the performance of the construction industry.

2.3 THE PERFORMANCE OF THE UK CONSTRUCTION INDUSTRY

Performance can be considered as an evaluation of how well individuals, groups of individuals or organisations have done in pursuit of a specific objective (Ankrah and Proverbs, 2005). These objectives vary significantly, but from an industry or organisational perspective, they generally revolve around satisfying the key stakeholders notably customers, employees, shareholders, the various suppliers, government and society as a whole. Mullins (2005) described performance as relating to such factors as increasing profitability, improved service delivery or obtaining the best results in important areas of organisational activities. In construction, because of the numerous participants who contribute towards the achievement of project objectives, performance has been defined in one sense as a participant's (client, architect or contractor) contribution to the execution of the task required to complete the project (Soetanto, 2002). Indeed most of the research published in the construction management literature on performance in the construction context mainly focus attention on the contractor's role (cf. Assaf *et al.*, 1996; Baldry, 1996; Belassi and Tukel, 1996; Straight, 1999; Proverbs and Faniran, 2001; Kashiwagi and Byfield, 2002; Xiao and Proverbs, 2002a; 2002b; Costa and Formoso, 2004).

It has been argued by Ankrah *et al.* (2005a) that performance in this context may also be approached from two perspectives; the first relating to the business performance of the contractor and the second relating to the performance on projects. The former is very rarely the subject of construction management research and is normally assessed using financial results and ratios, productivity figures, comprehensive self-assessment tools such as the balanced scorecard (Kaplan and Norton, 1992), or a synthesis of some of the existing generic self-assessment tools (Mbugua, 2000). In many cases however as observed by Bassioni *et al*. (2004), references to performance (whether contractor or construction industry performance) and research in this genre have been focused on project performance (cf. Soetanto *et al.*, 2002; Xiao and Proverbs, 2003). This has been the case because the characteristics of the industry are such that a project is often a major business endeavour representing a major investment by the client (Hobday, 2000), and representing a major part of a participant's annual turnover (Fellows *et al*., 2002). This implies that ultimately it is the project performance that determines overall business performance. These characteristics make project performance critical.

Because the client is the principal stakeholder in the construction process, good performance has been defined typically in terms of the delivery of projects on time, to specification and within budget, providing good service and achieving reasonable life-cycle costs. More recently, the requirements of the other stakeholders such as employees and society have come into focus with the need to promote sustainable construction and corporate social responsibility, and this is reflected in a more comprehensive set of industry Key Performance Indicators (KPIs) of project performance covering such issues as environmental protection and respect for people (DTI, 2004).

Although the construction industry in the UK is considered world class at it's best (Egan, 2002), it is also true that over the years and irrespective of the KPIs assessed, construction projects in the UK have in the main failed to satisfy stakeholders, and this has led to the publication of such reports as the

Rethinking Construction (Egan, 1998) and the Accelerating Change (Egan, 2002) reports, all calling for performance improvement in the industry. These reports represent the latest manifestations of continuous end-user dissatisfaction which according to Cain (2004) can be traced back at least 70 years. Reports on the construction industry stemming from Simon (1944) have recounted the same industry failures time and time again.

Attempts have been made to quantify the poor performance of the construction industry and these computations have revealed, for instance, that unnecessary costs of construction projects exceed 30% of the capital costs (Latham, 1994). Cain (2004) put this figure at around 42%. As of 1999, a significant proportion of projects were late (58.4%), over budget (32.2%) and had defects (90% - including major and minor defects). This was according to a survey reported in CCF/CBPP (1999). When compared with more recent reports such as Kashiwagi *et al*. (2006) which also stated that only 45% of clients in the UK indicated that the costs were on target and 62% of projects on time, it can be seen that there is still much room for improvement in project performance.

Beyond these manifestations of poor performance, Pearce (2003) also reported that in absolute terms from 1998/1999 to 2000/01, construction had the worst record for the number of fatalities (33%) and major non-fatal injuries (34.4%) in all industries, imposing a social cost of over £2 billion a year on the UK economy. Entry into construction-related university degree programmes is also declining (Pearce, 2003). These are all symptomatic of an industry performing poorly.

The story of the construction industry is not just a tale of woe as there are examples of world class projects that have been delivered by the industry. Some examples of such projects have been identified in Reisner (2005). However, the many high profile cases of poor performance have overshadowed the good achievements of the industry. The well-documented tales of the Scottish Parliament which was ten times over budget and two years behind schedule (cf. Clark and Barrick, 2003) and the saga of the new Wembley stadium (BBC, 2002; 2006) are recent and current high profile examples of the inability of the industry to deliver projects that meet the requirements of key stakeholders. It is believed that the perpetuation of this poor performance is because the industry continues to be blind to its failings (Cain, 2004).

Following Latham (1994) and especially Egan (1998), it has become more difficult to "misinterpret, ignore or shrug off" calls for performance improvement (Cain, 2004), and more so because these calls for change have been client driven and specific targets that have been defined for the industry to pursue, and also because powerful organisations such as the Construction Clients Forum, Rethinking Construction organisation, Movement for Innovation (M4I), and the Constructing Excellence programme have been set up to push forward the performance improvement agenda (Cain, 2004). These initiatives have led to some improvements in performance although data to quantify these improvements is still limited because of the limited implementation of performance measurement. The surveys conducted by CCF/CBPP (1999) and CIB (1999) for instance provided evidence of a 16% overall performance improvement from 1995 to 1999, with as many as 8 out of 10 repeat clients in 1999, happy to use the same contractors on future commissions. There is however a lot more room for improvement.

Within the research environment, the under-achievement has inspired extensive research on construction project performance examining the factors that influence it in the hope that through measurement and benchmarking, changes can be made to these factors to improve the services offered by the construction industry. Studies conducted in this field so far have focused on demonstrating the influence of such factors as procurement routes, management systems and techniques, and construction methods (cf. Larson, 1997; Proverbs *et al.*, 1999; Tam *et al.*, 2000; Soetanto, 2002). The range of factors captured in the literature on performance are considered in the following section.

2.4 FACTORS INFLUENCING PROJECT PERFORMANCE – A REVIEW OF SOME CRITICAL SUCCESS FACTORS

The performance of a construction project is influenced by a multitude of inter-related factors some of which are referred to in the literature as critical success (or failure) factors (Fortune and White, 2006). These factors may be classified as being project-related, organisation-related, industry-related or external factors as shown in Figure 2.4 which summarises the foregoing discussions on the way in which performance is typically perceived and factors influencing performance. The factors captured in Figure 2.4, which are by no means exhaustive, have been compiled from sources including Assaf *et al.* (1996), Belassi and Tukel (1996), Ching Ming and Harris (1996), Russell *et al.* (1997), Hatush and Skitmore (1997b), Ng and Skitmore (1999), Chan *et al.* (2004), Belout and Gauvreau (2004) and Dainty *et al.* (2004). In a review of some 63 articles on the critical success factors (CSFs) of projects (including non-construction projects) covering some of the sources cited above, Fortune and White (2006) identified at least 27 CSFs comprising factors like support from senior management, clear realistic objectives, detailed plan kept up to date, good communication, user/client involvement, skilled and sufficient staff, competent project manager, proven technology, realistic schedules, past experience, project size and complexity. This list of factors reinforced a previous list of 24 empirically derived CSFs in White and Fortune (2002). Although not specifically addressing the construction project context, these factors generally hold true for construction projects as well and are consistent with those factors identified in Figure 2.4. By definition, CSFs are areas of activity that should receive constant and careful attention from management to ensure attainment of organisational goals (Rockart, 1979 in Fortune and White, 2006). This implies that in seeking to improve performance on construction projects, it is necessary to understand each of these factors and to investigate how they each impact on performance outcomes and how they interact also to influence performance outcomes. A lot of research has been undertaken in this domain in respect of each of these factors, and these studies have yielded valuable insights. Notable examples include studies like Majid and McCaffer (1998), Proverbs *et al.* (1999), Xiao and Proverbs (2002c), and Moselhi *et al*. (2005).

When considering the role that the various project participants can play in influencing the above-mentioned factors, it is useful to classify these factors into uncontrollable and controllable factors (Soetanto, 2002). From a project perspective, uncontrollable factors include the external constraints and industry factors as shown in Figure 2.4. By definition, these are beyond the control of project participants and hence may be difficult, if not impossible to influence at a project level in trying to improve performance.

Of particular relevance are the controllable factors which include such project and organisation-related factors as procurement route, contracts, variations, project complexity, project duration and cost, design time, plant and equipment, personnel, interaction between project participants, some process-related issues, skills and capability, health and safety, quality and specific company programmes (Soetanto, 2002). These are factors on which at least one of the participants within the CPO can bring to bear some amount of control and as a result influence the course of a project. To highlight a few of the commonly recognised and widely researched factors, some of these factors are examined in greater detail below to give a sense of the manner in which researchers have established that they influence the delivery of projects.

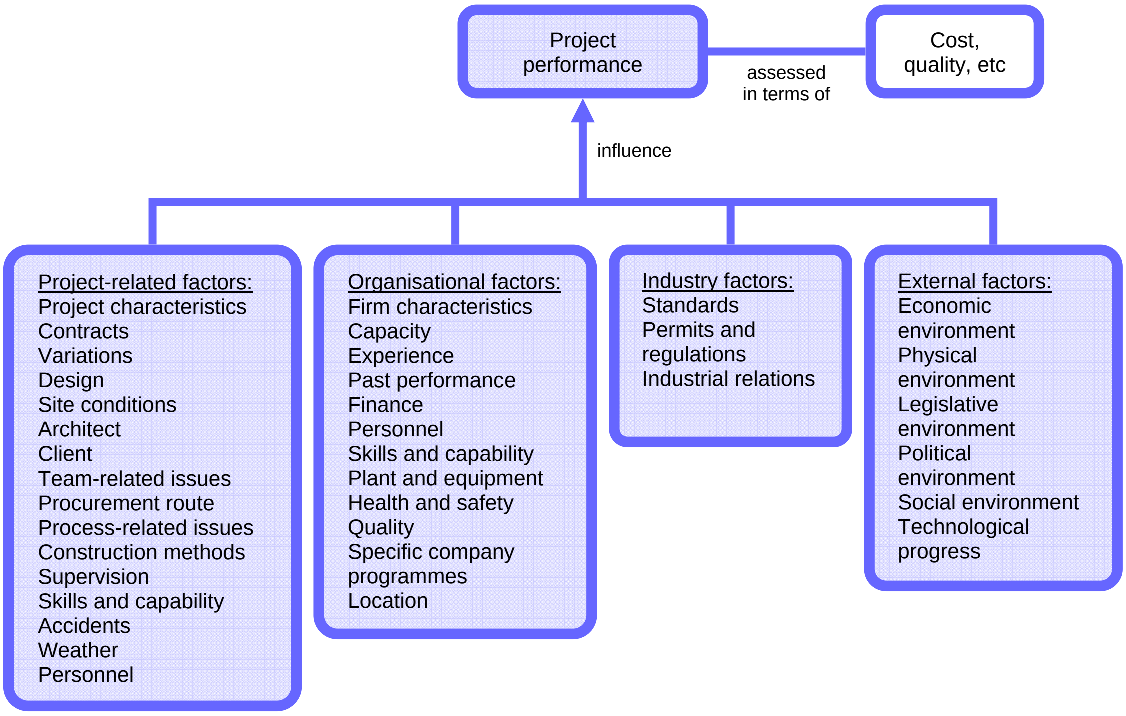

Figure 2.4 Factors influencing contractor performance

2.4.1 Procurement route

Procurement routes have a fundamental impact on performance to the extent that certain routes, such as the traditional procurement systems, promote segregation and antagonism with participants working, in some cases against each other, to avoid losses (Latham, 1994). Procurement systems involving partnering arrangements have positive effects on performance by fostering cooperation, teamwork, commitment and a proactive attitude of participants (Cook and Hancher, 1990; Crowley and Karim, 1995; Drexler and Larson 2000; Xiao and Proverbs, 2002c; Naoum, 2003; Packham *et al.*, 2003). Some of these issues are discussed in Kashiwagi *et al.* (2006) which even recommends a performance-based procurement approach as a solution to poor performance.

2.4.2 Contracts

Contracts, a feature in all procurement arrangements, are instruments for recording obligations and responsibilities and allocating risks (Soetanto, 2002). The form and clarity of contracts, the quality of documentation, and the method of payment have significant impacts on performance. Ambiguous and inappropriate contracts that allocate risks wrongly, lead to disputes and conflicts, and these detract from the pursuit of project goals resulting in poor performance (Godfrey, 1996; Artama Wiguna and Scott, 2006). Among other factors, Chua *et al*. (1999) identified proper contractual arrangements which identify and allocate risks equitably, provide realistic obligations and clear objectives and targets, provide for formal dispute resolution processes, and also include motivation and incentives to the contracting parties, as a critical success factor for construction projects.

2.4.3 Variations

Variations have been identified in Kaming *et al*. (1997) as significant influences on time and cost performance. Variations arise from a variety of sources including the client, architect, management errors and other unforeseen circumstances or events that arise during construction (Akinsola, 1997). Firstly, their valuation can lead to conflicts and disputes. Secondly, they may result in delays and reworking with their attendant costs and programme disruption. There are also indirect cost and time implications associated with claims documentation. Through these various effects, variations reduce labour productivity significantly (Sutrisna and Potts, 2002), and by extension, project performance.

2.4.4 Project complexity

Project complexity influences contractor performance to the extent that a project may require specialised skills or specialised plant and equipment. Where these are unavailable, the effect on project delivery may be increased duration and cost, and compromised quality. Factors related to complexity include percentage design completed prior to work on site, design time, project duration and cost, plant and equipment, and personnel. Percentage design completed prior to work on site introduces an element of complexity and additional burden on participants (Soetanto, 2002). It affects planning and programming and may result in considerable delays. Design time, project duration and cost, which are also measures of project complexity, influence performance in like manner. The correct choice of plant and its availability and by extension the policy of the contractor as regards plant and equipment ownership could also potentially have an impact on performance especially where specialised plant and equipment are necessary to undertake work. Likewise the personnel factor which covers the manpower resources available on the project, the qualification, experience, skills and expertise, organisational structure as well as the management capabilities of key personnel (Dozzi *et al.*, 1996; Hatush and Skitmore, 1997b). Project success is dependent on having the right personnel on the project in a labour intensive industry like construction. This has implications for recruitment of personnel.

2.4.5 Segregation

Segregation between participants and roles is one of the principal causes of poor performance hence Latham's (1994) "Constructing the team" report. Interaction between the project participants, particularly early in the construction process promotes buildability, and this reduces the likelihood of variations, defects and associated reworking, delays, additional costs and conflicts. This factor covers harmonious working relationships which according to Soetanto *et al.* (2001) is an essential ingredient of project success, and also covers the level and quality of communication that occurs between participants. The provision of an appropriate network and necessary data to all key workers is one of ten key factors influencing project success (Belout and Gauvreau, 2004).

2.4.6 Management philosophies

Management philosophy relating to such issues as supply chain management and total quality management (TQM) affects the way a project is managed on site. TQM for instance is about the quest for customer satisfaction, increased competitiveness, continuous improvement in quality, leadership, teamwork and empowerment (Ngowi, 2000; Thomas *et al*., 2002). Although it is often perceived in construction only as a marketing tool (Thomas *et al*., 2002), this philosophy when applied effectively influences performance positively (Ngowi, 2000; Love *et al*., 2004). According to Laszlo (1998), TQM leads to improvements in efficiency, product and service quality levels, as well as excellence in thinking and high quality work methods.

2.4.7 Process-related issues

Process-related issues capture many of the CSFs including decision-making, monitoring and control procedures, recording and reporting systems, management support, and involvement of participants (Lim and Mohammed, 1999). Globerson and Zwikael (2002) for instance captured the importance of monitoring and control mechanisms for proper project completion. The more efficient and effective the systems that regulate these issues, the better the overall performance of a project. These factors facilitate the flow of information, feedback and teamwork, and allow knowledge to be drawn from all parts of the value chain.

2.4.8 Health and Safety policies

The health and safety (H&S) policy of the project organisation (often dictated by the dominant participant) influences the likelihood of accidents occurring on the project. The construction industry as highlighted previously has a bad reputation in relation to H&S (Pearce, 2003). With H&S increasingly becoming an important measure of performance, as reflected in the various contractor selection frameworks (cf. Hatush and Skitmore, 1997a; 1997b), the

H&S policy in place to prevent the occurrence of accidents takes on greater significance. In identifying factors influencing performance Chan *et al*. (2004) identified the implementation of an effective safety programme as a critical success factor of construction projects. Assaf *et al.* (1996) likewise identified adherence to safety rules and regulations within such a programme as important. Fewer accidents, which a good policy ensures, not only improves the reputation of the contractor, but also reduces delays and adds to the overall satisfaction of project participants.

2.4.9 Quality management policy

The quality management policy of the contractor employed in the management of the project determines the quality outcomes of the project and has implications for the number of defects, amount of reworking required and their associated delays and costs (Xiao and Proverbs, 2002c). It is for these reasons that Chan *et al.* (2004) recognised the implementation of an effective quality assurance programme as a critical success factor in project delivery. Indeed quality management has evolved from quality control (QC) which is reactive and concerned with error detection, through quality assurance (QA) which is concerned with error prevention, to TQM which is proactive and concerned with continuous improvement (Thomas *et al*., 2002). It is suggested *ibid* that the construction industry is only just beginning to make the transition from QC to QA. Even fewer construction organisations are going further to embrace TQM. This implies that different quality policies are likely to exist with different consequences for quality outcomes.

2.4.10 Specific company programmes

Specific company programmes such as formal training regimes are an important indicator of the value placed on employees by the organisation. They serve to improve the skills and capabilities or competence (as defined in

Dainty *et al*. (2004)) of employees, and this results in improved workmanship, project management and performance.

The above discussion provides an indication of the range of factors influencing performance. These factors are inter-related in very fundamental ways with for instance procurement route influencing the choice of contract, and the project complexity influencing number of variations. Research on these factors abound in the construction management literature, with some of these studies highlighting the choices being made by project participants in respect of these factors and the resultant outcomes. Love *et al.* (2004) for instance examine the implementation of TQM and its outcomes for eight Australian construction organisations, drawing lessons from their experiences. The extensive research not withstanding, it can be argued from the deficit that still exists in performance that there is a need for fresh perspectives to complement the existing research and provide new insights for improving performance.

2.5 A 'SOFTER' PERSPECTIVE

Some of the factors influencing performance like management support, communication, relationships, involvement of participants and decision-making (cf. Belassi and Tukel, 1996; Chua *et al*., 1999; Chan *et al*., 2004; Fortune and White, 2006) are what may be described as 'soft' factors relating to attitudes and behaviours of participants within the CPO. In the management and organisational behaviour literature, such factors are often captured under the organisational culture construct (Hampden-Turner, 1994; Egan, 1998; Alvesson, 2002; Ankrah and Langford, 2005). This construct (borrowing from Smircich (1983)) provides a rich instrument for perceiving and understanding the operation of the CPO. Whilst organisational behaviour and management scholars have derived huge benefits from the rich imagery and metaphors associated with this construct to facilitate understanding and communication of their organisational experiences and also to explore organisational effectiveness and performance, the same cannot be said for the construction project experience. This situation may be due in part to the fact that reading through the performance literature, organisational culture as a construct does not receive much mention as a factor influencing performance. Although it is identified in Dozzi *et al.* (1996) and Chua *et al.* (1999) as a performance influencing factor, this mention is not commonplace. The implication has been that the construct of culture has not received as much attention as some of the other factors like procurement route or construction methods in the quest for performance improvement.

This construct of culture is however coming to the fore within construction circles with construction industry reports like Latham (1994) and Egan (1998), and other published research berating the culture of the construction industry and blaming it for many of the industry ills, in particular the adversarial and antagonistic aspects that according to them have persistently plagued the industry and affected performance. The general consensus is that there is a need for cultural change within the construction industry for performance to be improved.

Although there is increasing interest in construction research in the culture domain (e.g. Serpell and Rodriguez; 2002), this research into the phenomenon of culture and particularly its effects on performance which can/should inform such cultural change has so far been disparate and inadequate as will be demonstrated in the following chapter. Its specific role in contractor performance is still not clearly apparent. Where it has been suggested as influencing performance outcomes (cf. Dozzi *et al.*, 1996; Chua *et al.*, 1999), the nature of the implied relationships between organisational culture and performance still remain unclear and as a result, it has not been possible to identify 'best practice' cultures most suited to the peculiar nature and needs of construction. This fact is also recognised by Phua and Rowlinson (2004) who point to the lack of rigorous and empirical support for the supposed positive relationship between culture and project success, with the general tendency being to 'black box' culture and use it when no other reasons can be adduced to explain the issues concerned (Fellows and Seymour, 2002). As a result, it has been difficult to advocate and build those cultural orientations associated with improved performance, and to take steps to mitigate the effects of those orientations associated with poor performance.

This situation implies therefore that further studies of the complex relationships between culture and performance are very much needed and would provide a significant contribution to the body of knowledge on construction project performance. As argued in Chua *et al.* (1999), it is the identification of key factors affecting construction project success that ensures the appropriate allocation of limited resources. It would be illogical to devote resources to cultural change initiatives without any evidence of its usefulness in improving project performance.

2.6 SUMMARY

The construction industry is responsible for the delivery of the UK's built environment. Current turnover for the industry (in respect of contractors' output alone) exceeds £107B, and it employs by some counts up to 2M people. Clearly, this industry is significant in its size and structure, and more importantly in its contribution to the UK economy. Clients expect products that meet clearly specified requirements. Unfortunately, the industry has by and large failed to meet these client requirements. This state of affairs has inspired a significant amount of research into the performance of the construction industry and factors influencing performance outcomes with the emphasis being on project performance. Some of these factors have been discussed in this review. Whilst several of the factors identified in the literature are 'soft' factors which stem from the culture that exists within the CPO, few direct references to organisational culture are made in the performance literature. Even where references to organisational culture are made in the performance literature, the extent of its impact are not set out. This situation inevitably implies a difficulty in assessing the likely performance outcomes of cultural change, and shows that there is a gap in the knowledge on cultural orientation and performance that needs to be explored. The next chapter begins this exploration process by delving into this construct of organisational culture and examining its impacts on performance generally and in particular from a construction project perspective.

CHAPTER 3: THE ROLE OF CULTURE IN DETERMINING PERFORMANCE OUTCOMES

3.0 INTRODUCTION

It was suggested in the preceding chapter that factors like 'culture' need to be taken more seriously when looking at improving effectiveness and performance in construction. To demonstrate the importance of this phenomenon of culture and to address the second key objective of this research, this chapter is devoted to a critical review of (organisational) culture; in particular the role that it plays in determining organisational outcomes, and the theories underpinning its conceptualisation and investigation. The chapter also interrogates literature within the construction domain on research undertaken in this genre, the aim being to establish how it is conceived in construction management research, the extent to which it has actually been researched in construction, and the scope that still exists for further research.

3.1 CULTURE AND PERFORMANCE

It has long been recognised that organisational culture plays a significant role in performance outcomes. This recognition has been implicitly and explicitly expressed in several quarters, mainly in the mainstream organisational behaviour and management literature (cf. Baker, 2002; Smith, 2003; Tharp, 2005). According to Smircich (1983) and Hatch (1993), the idea that business organisations have a cultural quality that is relevant for performance was recognized as far back as the 1970s as evidenced by the publication in 1980 of Business Week with the cover story "Corporate culture: The hard-to-change values that spell success or failure" (Business Week, 1980 in Smircich (1983)). In particular, Deal and Kennedy (1982) and Peters and Waterman (1982) were instrumental in popularising this notion that certain cultural orientations lead to organisational effectiveness and strong performance. Others (cf. Ouchi, 1981; Schein, 1985; Kotter and Heskett, 1992; Alvesson, 2002; Smith, 2003) also made similar assertions, although many of these assertions were based only on anecdotal evidence, which rightly or wrongly were described as being selective (Denison and Mishra, 1995).

Empirical studies to confirm the relationships between culture and performance have been relatively limited, and generally not well received (Wilderom *et al*., 2000). This, according to Denison and Mishra (1995), has been mainly as a result of the critique of the application of positivist approaches to the social sciences. Where such studies have been conducted (cf. Denison and Mishra, 1995), it has been found for instance that the cultural traits of involvement and adaptability were strong predictors of growth whilst consistency and mission were strong predictors of profitability. Christensen and Gordon (1999) and Wilderom *et al.* (2000) also catalogued other empirical studies that uncovered similar relationships.

Beyond just particular cultural orientations, it has also been noted by Deal and Kennedy (1982) and Kotter and Heskett (1992) that there are correlations between strong cultures and the strong performance of some organisations. Here a strong culture is measured by the degree to which all sections of the organisation buy into key aspects of the culture (Thompson, 1993).

Clearly, there is sound basis in the literature for the hypothesis that the performance of construction projects is influenced by the culture of the CPO. This represents the main hypothesis that this research seeks to explore. As a first step in this direction, it is necessary to understand this phenomenon of culture and how it comes to be so important in performance outcomes.

3.2 THE PHENOMENON OF CULTURE

As pointed out in Ankrah and Proverbs (2004), considerable effort has gone into attempts to develop a definitive interpretation of culture. However, this goal appears to have eluded the many researchers exploring this area, and this situation can be attributed to the various perspectives from which the concept of culture can be approached and the various theories underpinning these perspectives. The evidence of this is in the plethora of definitions available, with Kroeber and Kluckhohn (1952, in Bodley 1994) for instance reported to have compiled a list of over 160 different definitions of culture. In many ways, the study of culture can be likened to the story of the six blind men and the elephant as narrated by Saxe (1963), and as used metaphorically by Roberts and Boyacigiller (1993) when they questioned whether the elephant (culture) was too large or researchers were too blind.

Whether the elephant (culture) is too large or the researcher too blind, the specific concept of culture that a particular researcher adopts is an important matter as it influences the research questions asked, the problems investigated, the methods applied and the interpretation of results (Bodley, 1994). This implies that in undertaking any critical investigation into any aspect of culture, the researcher needs to define the perspective of culture being assumed and its underpinning theories in order to set the context within which the research can be considered as being valid.

3.2.1 An overview of culture

Barthorpe *et al*. (2000), in presenting an overview of culture, examined the evolution of the term and pointed to its initial historical association with the cultivation of land and production of crops, and breeding of animals. This perspective has gradually evolved to current views of culture as the totality of socially transmitted behaviour patterns, arts, beliefs, institutions, and all other products of human work and thought (American Heritage Dictionary, 2000). Its modern definition of socially patterned human thought and behaviour is attributed to renowned anthropologist Edward Tylor, who is believed to have first used the term in its true anthropological sense (Payne, 1996; Barthorpe *et al.*, 2000). Tylor's definition of culture is captured in Rooke (2001) as "that complex whole which includes knowledge, belief, art, morals, laws, custom, and any other capabilities and habits acquired by man as a member of society".

A cross-disciplinary definition of culture proposed in Hofstede (2001) is that culture is "transmitted and created content and patterns of values, ideas, and other symbolic-meaningful systems as factors in the shaping of human behaviour and the artefacts produced through behaviour."

Another well-known definition takes culture to be patterned ways of thinking, feeling and reacting, acquired and transmitted mainly by symbols, constituting the distinctive achievements of human groups, including their embodiments in artefacts (Kroeber and Kluckhohn, 1978 in Hofstede, 2001). This definition is akin to Bodley's (1994) simplified representation of culture as "what people think, what they do, and the material products they produce." Hofstede (2001) also defined culture as "the collective programming of the mind that distinguishes the members of one group or category of people from another."

Culture acts like a template and shapes behaviour and consciousness within a human society from generation to generation (Miraglia *et al.*, 1999). Essentially, it operates as a decodifier (Serpell and Rodriguez, 2002), defining situations and words, and giving them new meaning.

Culture exists in a constant state of change (Miraglia *et al.*, 1999), and this may to some extent account for the difficulty in defining it. The various perspectives and definitions notwithstanding, a number of themes are common to all the different interpretations which are fundamental to understanding culture *viz*:

- Culture is learned and shared;
- Culture is determined by contextual factors, implying that it is peculiar only to the group to whom these factors apply;
- The underlying basic problems are common and include relation to authority, concept of masculinity and femininity, and ways of dealing with conflicts; and
- Culture shapes behaviour and manifests in the form of values and practices.

Perhaps the most important theme of all is the universal recognition that such a phenomenon or concept as culture does indeed exist.

According to Allaire and Firsirotu (1984), the various definitions fall into very well demarcated schools of thought on culture in anthropology with specific conceptual assumptions and approaches to cultural investigation. This implies that accepting a particular definition imposes a commitment to the specific conceptual and theoretical underpinnings of that definition and ways of studying culture.

3.2.2 Theories of culture

Historically the study of culture is rooted in the fields of anthropology and social anthropology. According to Hatch (1993) the cultural phenomena has been dealt with more outrightly by anthropologists than by any other group of scientists or scholars. It is therefore logical in studying this phenomenon, irrespective of the context, that the anthropological perspectives are examined.

Allaire and Firsirotu (1984) provide an insightful treatise on the diverse and complex theories that cultural anthropologists have proposed. Figure 3.1 below summaries these theories and schools of thought. The first distinction is between theories in which culture is seen as meshed into the social system (*sociocultural system*) and those in which culture is seen as an *ideational* system (a system of ideas) conceptually and analytically distinct from the social system (Allaire and Firsirotu, 1984). These theories are examined below.

3.2.2.1 Culture as a sociocultural system

Among those theorists who took a sociocultural view of culture, Allaire and Firsirotu (1984) identified four schools of thought based on their notions of time. Two schools focused on the study of culture at particular points in time and space. Termed *synchronic,* these were the functional and the functional-structuralist schools of thought.

In the functionalist school championed by the likes of Malinowski, culture is seen as an instrumental apparatus by which a person is put in a better position to cope with the concrete specific problems faced in the effort to satisfy their needs. This presupposes that myths, institutions and other manifestations of culture will exist only to the extent that they enable individual members of society to satisfy their individual needs. The commitment this need-grounded theory imposes on research is that it requires the researcher to focus on the individuals within the culture and their needs.

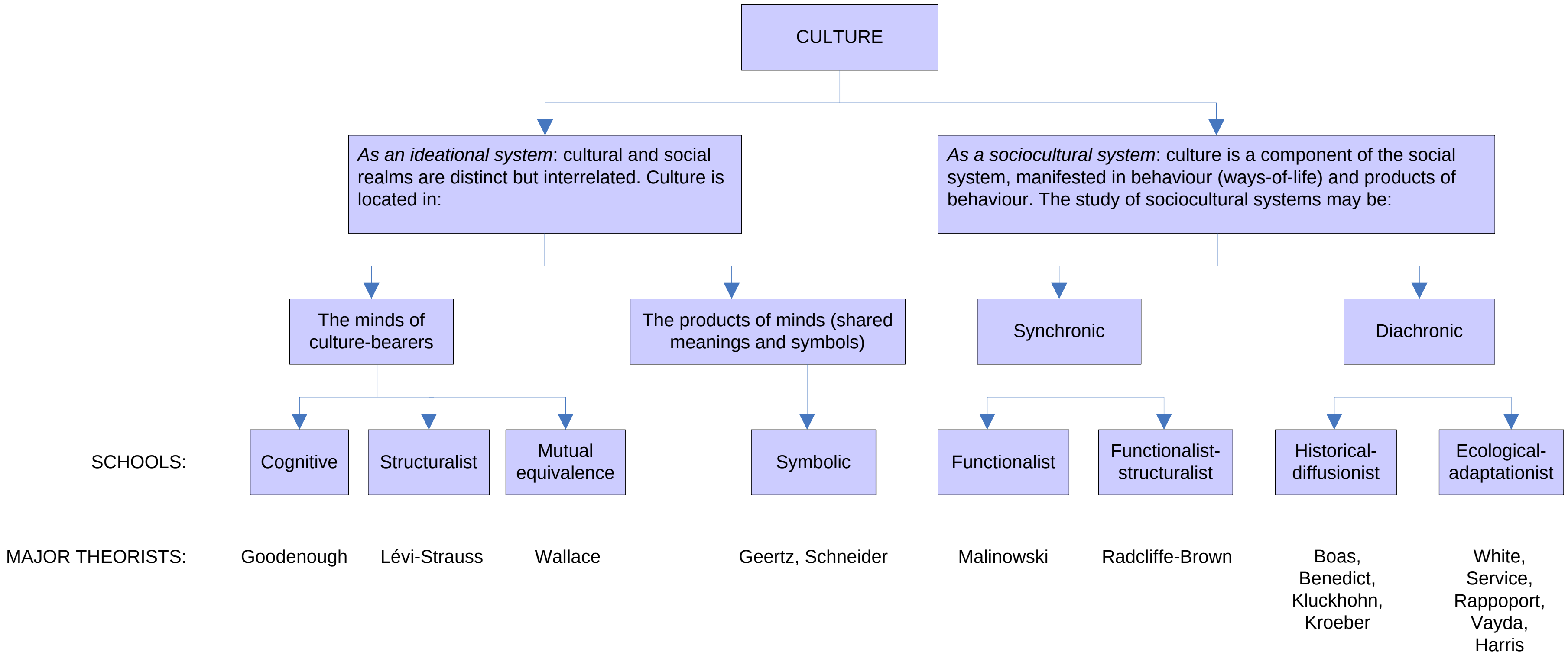

Figure 3.1 A typology of the concepts of culture [Source: Allaire and Firsirotu (1984)]

In the structural-functionalist school of thought, culture is an adaptive mechanism by which people are enabled to live a social life as an ordered community in a given society (Allaire and Firsirotu, 1984). Structural-functionalists posit society as an integration of institutions (such as family and government) with culture as the system of normative beliefs that reinforces these social institutions (Hammond, 1978; Infoplease, 2005).

The other two schools; the *historical-diffusionist* and the *ecological-adaptationist* schools, consider the time dimension as well and focus on the processes involved in the development of a culture. These are classified as *diachronic* (Allaire and Firsirotu, 1984). The historical-diffusionist school regards culture as consisting of temporal, interactive, superorganic and autonomous forms produced by historical circumstances and processes (Allaire and Firsirotu, 1984). Many early anthropologists conceived of culture as a collection of traits and studied the diffusion, or spread, of these traits from one society to another. Critics of diffusionism, however, pointed out that the theory failed to explain why certain traits spread and others do not (Infoplease, 2005).

The ecological-adaptationist school of thought perceives culture as a system of socially transmitted behaviour patterns that serve to relate human communities to their ecological settings. Ecological approaches explain the different ways that people live around the world not in terms of their degree of evolution but rather as distinct adaptations to the variety of environments in which they live. They also demonstrate how ecological factors may lead to cultural change, such as the development of technological means to harness the environment (Hammond, 1978; Infoplease, 2005). As explained in Allaire and Firsirotu (1984), the sociocultural system and the environment are involved in a process of reciprocal causality, each an active influence on the other; their interaction representing an important feature of this school.

3.2.2.2 Culture as an ideational system

And then there are the *ideational theories*. Among the ideational theorists where the emphasis is on the cognitive, Keesing (1974) distinguished three very different schools; the *cognitive, structuralist* and *symbolic* schools. Allaire and Firsirotu (1984) also isolated a further fourth school of thought which was termed the *mutual equivalence* school. These four schools can be classified into two groups. For the first group, culture is located in the minds of the culture-bearers. There are three schools of thought within this group; the *cognitive, structuralist* and *mutual equivalence* schools (refer to Figure 3.1).

The cognitive school views culture as a system of knowledge, of learned standards for perceiving, believing, evaluating and acting (Allaire and Firsirotu, 1984). Within this school, culture is clearly not considered to be a material phenomenon (Goodenough, 1961 in Keesing, 1974) or about patterns of recurring events (Goodenough, 2003). Rather, Goodenough (2003) defines culture as:

> *"consisting of criteria for categorising phenomena as meaningful,…deciding what can be,…deciding how one feels about things (preferences and values),…deciding what to do about things,…deciding how to go about doing things, and the skills needed to perform acceptably."*

For the structuralist school, culture is made up of shared symbolic systems that are cumulative products of the mind, a reflection of unconscious processes of mind that underlie cultural manifestations (Allaire and Firsirotu, 1984). Here the essence of studying culture is to uncover those principles of mind that generate cultural elaborations like myths, art, kinship and language (Keesing, 1974).

Within the mutual equivalence school, culture is seen as a set of standardised cognitive processes which create the general framework for the mutual prediction of behaviour among individuals interacting in a social setting (Allaire and Firsirotu, 1984).

The second group considers culture to be made up of shared meanings and symbols. This group has the *symbolic* school of thought in which culture is seen in the "meanings and thinkings shared by social actors" (Allaire and Firsirotu, 1984; Geertz, 2001). Here the focus is on examining shared codes of meaning (Keesing, 1974) or how people's mental constructs guide their lives (Infoplease, 2005). In Keesing's (1974) treatise on theories of culture this perspective, as well as the others, is elaborated at length.

As emphasised in Keesing (1974), "culture does not have some true and sacred and eternal meaning [that theorists] are trying to discover". What these various perspectives and theories have sought to do is to enable researchers address key anthropological questions summarised *ibid* as: how have cultures developed and what forces have shaped them? How are cultures learned? How do shared symbolic systems transcend individual thought worlds? How different and unique are cultures? Do universal patterns underlie diversity? How is cultural description to be possible? The various theories offer alternative ways of investigating and addressing these questions. Indeed, whilst some researchers have advocated a synthesis of various theories to evolve a more holistic framework for understanding culture and its effects (cf. Allaire and Firsirotu, 1984), others have maintained that it is preferable to have even narrower conceptions of culture so that it includes less but reveals more (Hall and Neitz, 1993; Geetz 2001). This latter position is one with which this thesis concurs. This whole dilemma again is akin to the dilemma of investigating and describing the elephant (see Saxe, 1963).

3.2.3 Other perspectives of culture

Beyond the theoretical or definitional differences that have been discussed above, the study of this phenomenon of culture can also be approached from a number of different perspectives. For instance, it can be approached from the levels at which the phenomenon is observed (Erez and Gati, 2004) or from a convergence or divergence perspective (Abu Bakar, 1998).

3.2.3.1 The levels of culture

Arguably, culture can be observed at a regional (Hofstede, 1984), national (Trompenaars and Hampden-Turner, 1997; Hofstede, 2001), industry (Riley and Clare-Brown, 2001), organisational (Peters and Waterman, 1982; Deal and Kennedy, 1982; Hampden-Turner, 1994; Handy, 1995; Hofstede, 1997) as well as at the occupational level (Root, 2002; Rameezdeen and Gunarathna, 2003; Ankrah and Langford, 2005). According to Hofstede (2001), the word culture can be applied to any human collectivity or category such as an organisation, a profession, an age group, an entire gender, or a family. This particular perspective is important because it shows clearly that the construct of culture is applicable to a CPO context. From a dynamic view of culture espoused by the likes of Erez and Gati (2004), these various levels of culture influence each other in a "top-down, bottom-up" fashion, and inconsistencies between levels may instigate change and cultural adaptation or lead to conflict. What this means is that although culture is often portrayed as homogeneous, because of the existence of sub-groups within the wider collectivity, sub-cultures are likely to exist within the wider culture (Goodenough, 2003; Erez and Gati, 2004).

3.2.3.2 Convergence or divergence perspective

Another set of perspectives, which also reflects in culture research, is the convergence or divergence perspective (Abu Bakar, 1998) which focus on finding commonalities or differences in cultural characteristics. Trompenaars and Hampden-Turner (1997) referred to a situation of 'glocalisation' (derived from globalisation and localisation) vis-à-vis this dilemma of convergence or divergence. Along these same lines, Martin (1992) reports the integration, differentiation and fragmentation perspectives in organisational culture research.

These perspectives reflect the myriad of approaches that can be adopted in cultural studies and any such approaches adopted in research must be clearly identified and justified to avoid ambiguity and over-generalisation. In this study where the emphasis is on organisations (i.e. CPOs), it is important to examine the implications of these various theories for cultural studies of organisations and for understanding organisational culture. This will help clarify the appropriate approaches for this study.

3.3 CULTURE IN ORGANISATIONS

As indicated previously, the construct of organisational culture was popularised by the publication of such articles as Peters and Waterman's (1982) *'In search of excellence'* and Deal and Kennedy's (1982) *'Corporate cultures: the rites and rituals of corporate life'*. Before then, it was not considered important for organisational performance. However since these seminal publications, it has become an important issue in mainstream management (Smircich, 1983; Hatch, 1993; Barthope, 2002). In construction, it has only now begun, in the last two decades, to assume the importance it has in mainstream management.

Organisations are widely regarded as societies *writ* small (Allaire and Firsirotu, 1984). As little societies, organisations are imbued with similar structures and systems as the wider society. It is within this context that Allaire and Firsirotu (1984) argue that the concept of culture in organisations takes significance. Like societies, organisations are unique and their individuality may be expressed in terms of their cultures, much like the uniqueness of individuals is often expressed in their personalities (Eldridge and Crombie, 1974; Allaire and Firsirotu, 1984; McNamara, 1999). According to Deal and Kennedy (1982), every organisation has a culture, even if this culture is fragmented and difficult to read. This is also true for construction project organisations (CPOs). It has been argued in Ankrah *et al.* (2005b) that organisational behaviour within CPOs is not random which, extrapolating from Hofstede (1984), presupposes that there are cultures within CPOs that regulate behaviour. An implicit reference to this culture is made in Cherns and Bryant (1984) who posited that the relationships between the parties within the CPO is supplemented and moderated by informal understandings and practices which have evolved to cope with the difficulties that characterise construction projects. Evidence of such culture is also more explicitly reported in Thomas *et al.* (2002) who examined "project culture" and its impact on quality outcomes, and in Dainty *et al.* (2002) who examined its impact on women on construction sites – referring to a "site culture." Regardless of the label used in the construction domain, organisational culture is the concept of relevance and it is important to understand how it operates.

Like the generic concept of culture, various organisational behaviour theorists have different views on an appropriate definition for this phenomenon. This is probably because as indicated in Smircich (1983) the concept of culture has been borrowed from anthropology where, as shown from the previous section, no consensus on its meanings exists.

Schneider (2000) describes this as the problem of culture – being almost anything and thus being everything depending on who is conducting the specific piece of research. A loose definition of organisational culture has been presented as the way we do things around here to succeed (Schneider, 2000). More formally, it is defined as a pattern of shared basic assumptions that is learned by a group within an organisational setting through solving its problems of external adaptation and internal integration, which having worked well enough, is considered valid and taught to new members as the correct way to perceive, think, and feel in relation to particular problems (Schein, 1985). Eldridge and Crombie (1974) defined it as the unique configuration of norms, values, beliefs, ways of behaving and so on that characterise the manner in which groups and individuals combine to get things done. Hofstede (1997) also defined it as the collective mental programming that distinguishes the members of one organisation from another. McNamara (1999) argued that organisational culture comprised of the assumptions, values, norms and tangible signs (artefacts) of organisation members and their behaviours, with new members of an organisation, consciously or unconsciously, soon coming to sense the particular culture of the organisation just as they would another person.

It is an organisation's way of behaving, identity, pattern of dynamic relationships, 'reality', or genetic code, and it has everything to do with implementation of management ideas and how success is actually achieved (Schneider, 2000). It is often based on one or more philosophies related to the various stakeholders (Thompson, 1993), and is learned by new members through a process of socialisation. It can also be defined as the set of elements of an organisation that determines its way of acting, being, decision-making, communication and others (Serpell and Rodriguez, 2002).

Clearly these definitions have some resonance with the various theories of culture examined in the previous sections (see Table 3.1), and demonstrate as indicated by Smircich (1983) that the organisational culture concept has indeed been borrowed from anthropology. Indeed, as there is no consensus on culture's meaning in anthropology, it is not surprising that there is also a multiplicity of definitions and applications in the field of organisational studies. These definitions however provide a useful starting point for understanding organisational culture.

Table 3.1 Definitions of culture and linkages to organisational and management literature [Adapted from Allaire and Firsirotu (1984)]

SCHOOLS	DEFINITIONS OF CULTURE	LINKS WITH ORGANISATION/MANAGEMENT LITERATURE	MAIN THEORISTS AND RESEARCHERS IN ORGANISATION/MANAGEMENT THEORY
		A. Organisations as Sociocultural systems	
FUNCTIONALIST	Culture is an instrumental apparatus that enables a person to deal with specific problems in the quest of need satisfaction	Organisations are stages for playing out participants' quests for need satisfaction. The sociocultural system of the organisation will therefore reflect this quest for need satisfaction.	- Human relations school (Mayo) - Social man school (Homans) - Self-actualizing man (Maslow, Mcgregor) - Entrepreneurial and managerial motivations (McClelland) - The business policy field (Andrews)
STRUCTURALIST-FUNCTIONALIST	Mechanisms by which an individual acquires mental characteristics and habits that fit him for participation in social life.	An organisation is a purposive social system with a value subsystem that reflects the superordinate system (society).	- The structural-functionalist school (Parsons; Barnard) - Complex man (Schein)
ECOLOGICAL-ADAPTATIONIST	Culture is a system of socially transmitted behaviour patterns that serve to relate human communities with their ecological settings. The sociocultural system and the environment are involved in a process of feedback causality.	Organisations are social enactments that take on various forms through a continuous process of adaptation to critical environmental factors. Disparities in environments (perceived or real, present or future) result in different organisation forms.	- Open system theory (Katz and Kahn) - Contingency theorists (Thompson; Perrow) - Cross-cultural studies of organisations (Pascale; Hofstede et al.) - The socio-technical system perspective (Emery and Trist) - The Aston group (Pugh; Hickson) - The population ecology school (Hannan and Freeman; Aldrich) - The new school of organisation-environment relations (Pfeffer and Salancik)
HISTORICAL-DIFFUSIONIST	Culture consists of temporal, interactive, superorganic and autonomous forms which have been produced by historical processes	Organisational forms arise and vanish in the ebb and flow of historical circumstances. Specific patterns of organisational structures and strategies are characteristic of historical phases of the organisation.	- Chandler - Stinchcombe - Scott - Filley and House
		B. Organisations as Ideational systems	
COGNITIVE	A system of knowledge, of standards for perceiving, believing, evaluating and acting. Culture is the form of things people have in mind, their model for	- Organisational climate is defined as an enduring and widely shared perception of the essential attributes and character of an organisational system. - Organisations are social artefacts of members'	- Oranisational climate (Tagiuri; Schneider; Payne and Pugh) - Organisational learning (Argyris and Schön)

SCHOOLS	DEFINITIONS OF CULTURE	LINKS WITH ORGANISATION/MANAGEMENT LITERATURE	MAIN THEORISTS AND RESEARCHERS IN ORGANISATION/MANAGEMENT THEORY
	perceiving, relating and otherwise interpreting them.	shared cognitive maps	
STRUCTURALIST	Shared symbolic systems that are cumulative creations of mind. Since all cultures are the product of the human brain, there must be features that are common to all cultures.	Organisational structures and processes reflect the characteristics and limitations of human cognitive processes.	- March and Simon's cognitive assumptions - Cognitive style research (McKenney and Keen) - Left and right hemisphere of the brain (Mintzberg) - The managerial mind (Sumner)
MUTUAL-EQUIVALENCE	Culture is a set of standardised cognitive processes which create the general framework that enables a capacity for mutual prediction and interlocked behaviour among individuals.	Organisations are the locus of intersection and synchronisation of individual utility functions, the somewhat fortuitous site where actors' micro-motive coalesce into organisational micro-behaviour.	- The concepts of 'causal maps' and mutual equivalence (Weick et al.) - The 'calculus of participation' elements (Silverman) - Type A organisation (Ouchi and Jaeger)
SYMBOLIC	Culture is the fabric of meaning in terms of which human beings interpret their experience and guide their action. It is an ordered system of shared and public symbols and meanings which give shape, direction and particularity to human experience.	- Organisations, as a result of their particular history and past or present leadership, create and sustain systems of symbols which serve to interpret and give meaning to members' subjective experience and individual actions, and to elicit or rationalise their commitment to the organisation. - Organisations are figments of participants' ascriptions of meaning to, and interpretation of, their organisational experience. They have no external reality as they are social creations and constructions emerging from actors' sense-making out of on-going streams of actions and interactions.	- Interpretive, actionalist sociology of organisations (Weber; Silverman) - Institutional school (Selznick; Eldridge and Crombie; Harrison; Handy) - Phenomenology, symbolic interactionism and ethnomethodology (Turner; Garfinkel; Smircich)

A dilemma, similar to whether one ought to conceive culture as an ideational or sociocultural system, when trying to understand its operation in organisations is whether culture is something that an organisation '*is*' or something that an organisation '*has*' (Smircich, 1983; Ashkanasy *et al*., 2000). Whilst some theorists like Schein (1985) have favoured the former conception of organisational culture where culture is seen as something an organisation *is*, or as put by Smircich (1983) as a "*root metaphor*", it is clear from the literature that most researchers prefer to see it as something that the organisation *has* (cf. Deal and Kennedy, 1982; Peters and Waterman, 1982), a *variable* (Smircich, 1983), or as put by Hofstede *et al*. (1993) "…an assumed characteristic of an entire organisation".

When perceived this way, it can be presented as another variable that can be managed, controlled or manipulated by the organisation to achieve particular ends. This perspective has proved particularly attractive for organisational behaviour researchers and managers alike (Smircich, 1983), because it offers potentially another tool in the management arsenal for influencing the course of organisations. Smircich (*ibid*) identified two main strands of organisational research which have embraced this conception of organisational culture; these are the cross-cultural or comparative management strand and the corporate culture strand. Although this perspective can be criticised for reducing the concept of culture to just another management fad, its utility in helping to describe and make sense of the organisational experience is unquestionable. Table 3.1 adapted from Allaire and Firsirotu (1984) outlines some of the lines of enquiry emanating from this perspective and the researchers pursuing them. These are captured under the sociocultural paradigm.

When conceived as something an organisation *is*, the attention shifts from concerns about what organisations accomplish and how they can accomplish it more efficiently, to how organisation is accomplished and what it means to be organised (Smircich, 1983). Examples of research emanating from this line of enquiry include organisational cognition, organisational symbolism, and unconscious processes and organisation, which are more in line with the ideational perspectives of culture.

As can be seen from Schein's (1985) definition, organisational culture is rooted in the basic and universally shared problems (Schein, 1985; Hofstede, 2001), dilemmas (Trompenaars and Hampden-Turner, 1999) or contradictions (Quinn, 1988) which all groups or organisations have to deal with. Efforts made by the group to resolve these problems often yield solutions that are reliable and repeatable, and reflect the groups underlying cultural paradigm (Schein, 1985). Groups of people are faced with the same fundamental problems, but it is the unique solutions they find for these problems that sets them apart from each other, and is perceived as their culture (Hofstede, 2001). From the anthropological view of culture discussed previously, this perspective clearly sits very comfortably with the sociocultural schools of thought, in particular the functionalist and ecological-adaptationist theories of culture in which the environmental or situational contexts are emphasized, although unlike the functionalist view, organisational culture is not about the individual or their specific individual needs.

Again organisational culture from the definitions examined is about basic assumptions (Schein, 1985; McNamara, 1999), values and norms (Eldridge and Crombie, 1974; McNamara, 1999), beliefs (Eldridge and Crombie, 1974), and mental programmes (Hofstede, 1997). These reflect an acceptance of the cognitive or, more generally, the ideational aspects that anthropologists like Geertz (2001) and Goodenough (2003) have offered.

But organisational culture is also about artefacts (McNamara, 1999), ways of behaving (Eldridge and Crombie, 1974; Mullins, 2005), and how things are done (Schneider, 2000), which is again in the realm of the sociocultural.

Bringing these perspectives together it is reasonable to propose that *organisational culture* is that unique configuration of solutions – collectively evolved by organisational members – that an organisation and its members adopt in dealing with various organisational problems. The specific solutions chosen by an organisation represent "preferred" or "dominant" (Trompenaars and Hampden-Turner, 1999) behaviours and value orientations, and are the manifestation of the organisation's culture. In the context of this research, one CPO can be distinguished from another CPO by the specific solutions chosen to solve the same problems. This is consistent with Eldridge and Crombie (1994) who refer to the constant exercise of choice as being responsible for the individuality or cultural distinctiveness of organisations. From this definition, if the fundamental problems that organisations like CPOs contend with daily can be identified, then '*what is?*' questions can be asked to help identify the solutions employed in dealing with these issues. Such solutions will be a reflection of the culture.

Prior to the emergence of the organisational culture construct, organisational climate was the dominant construct for describing the organisational experience. Organisational climate can therefore generally be viewed as just an older term for organisational culture (Hofstede *et al.*, 1993). The relationship between these two terms is however slightly more complex than that. In studies of climate, the emphasis is on current state of organisations and the cognitive aspects – attitudes and perceptions, of individual organisational members. Organisational culture has a much deeper remit, as can be seen from the preceding discussions. Climate has been described as an artefact of culture (Schein, 2000). Payne (2000) even argued that it is possible to claim that climate is a way of measuring culture to the extent that it provides a useful generaliseable (although less accurate and specific) description of an organisation that is comparable with other organisations.

Hofstede *et al*. (1993) saw climate as being a short-term state and culture a longer-term state of an organisation. In an exposition of the relationships between the culture and climate paradigms, Denison (1996) concluded that the two research traditions should be viewed as differences in interpretation rather than differences in the phenomenon. It is therefore safe to agree with Hofstede *et al*. (1993) that organisational climate and culture are broadly complimentary constructs.

3.3.1 Importance of culture

The culture that exists within an organisation is important for a number of reasons. According to Thompson (1993) and also Kotter and Heskett (1992), for an organisation to be effective, congruence must exist between the organisation's values, its resources and the environment. Indeed it is common to find references to culture as an obstacle to change and problem resolution (Bate, 1984). The culture within the organisation reflects in the way that people perform tasks, set objectives and administer the necessary resources to achieve these objectives (Thompson, 1993). It also affects the way people make decisions, think, feel and act in response to the opportunities and threats affecting the organisation (Thompson, 1993).

The fit between cultural characteristics and management practices is considered to be another important factor in the successful implementation of management practices (Erez and Gati, 2004). According to Mullins (1993), a strong culture is crucial for successful management. It was noted in Deal and Kennedy (1982) that a strong culture sets out the system of informal rules which determines how people are to behave most of the time. A strong, unique, and appropriate corporate culture, in the view of Tharp (2005), has the ability to:

- reduce uncertainty by creating a common way to interpret events and issues;
- create a sense of order in that members know what is expected;
- create a sense of continuity;
- provide a common identity and a unity of commitment; and
- provide a vision of the future around which the company can rally.

Tharp (2005) also notes that organisational culture is now understood as an asset that should be managed and that can be leveraged in support of company goals. This is clearly in line with the school of thought that considers culture to be a *variable* or something the organisation *has*.

For Schein (2000), where culture matters most is in its impacts on the 'hard' stuff like strategy and structure. An existing culture tends to constrain and direct management behaviour, which subsequently affects overall performance through the mechanism of day-to-day practices such as decision-making, problem solving, and strategy formulation (Christensen and Gordon, 1999). Svensson and Wood (2003) also speak of the 'softer' aspects like business ethics which are a function of culture.

It manifests in folkways, mores, and the ideology to which organisation members defer, as well as in the strategic choices made by the organisation as a whole (Eldridge and Crombie, 1974). The *choices* organisational members make will be contingent on their culture.

As argued earlier, organisations are communities of people with a mission, and each organisation has its own core culture, character, nature and identity. These basic characteristics are so fundamental and deep in hierarchy that they tend to be much more powerful than business processes, financial systems, business strategy, marketing plans, team behaviour and corporate governance (Schneider, 2000). Culture defines appropriate behaviour, motivates individuals and asserts solutions where there is ambiguity. It governs the way a company processes information, its internal relations and its values (Hampden-Turner, 1994), and functions at all levels from the subconscious to the visible. Organisational culture is also believed to influence the success or otherwise of strategy, mergers, acquisitions and diversifications, integration of new technologies, meetings and communications in face-to-face relationships, and socialisation (Deal and Kennedy, 1982; Peters and Waterman, 1982; Graves, 1986; Thompson, 1993; Mullins, 2005). It also accounts somewhat for the existence of inter-group comparison, competition and conflict, and the productivity of the organisation (Schein, 1985). These views emphasise the important role of culture and provide further support for the perception that culture does have an impact on performance.

3.3.2 Composition of culture

As demonstrated in the discussions so far, culture manifests in a number of ways from the invisible and sometimes unconscious to very visible and tangible manifestations. The invisible aspects comprise values, beliefs and underlying assumptions (Schein, 1985; Bass, 1990; Hofstede, 2001). The visible aspects comprise artefacts, creations and behaviour norms (Schein, 1985) or symbols, heroes and rituals (Hofstede, 2001). Bass (1990) provides a more comprehensive list of these tangible aspects. These visible and tangible layers have been collectively referred to as '*practices*' in Hofstede *et al.* (1993) and Ankrah *et al.* (2005c). Hofstede (1997) represented these layers of culture by an onion diagram (Figure 3.2) with the core represented by the values and underlying basic assumptions, and the outer skins consisting of rituals, heroes and symbols of the organisation (Hofstede, 1997).

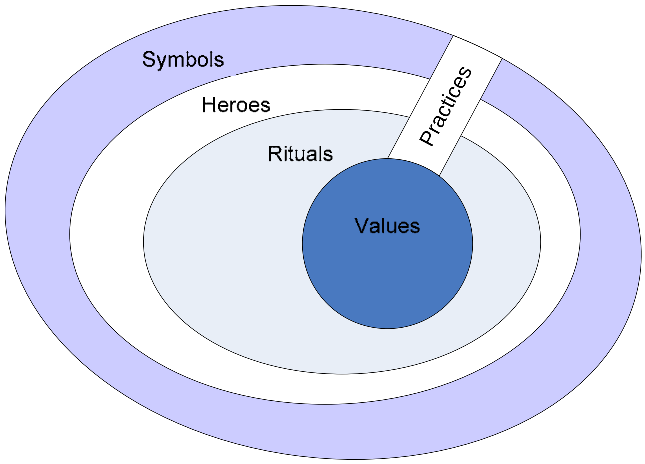

Figure 3.2 Hofstede's manifestations of culture [Source: Hofstede (2001)]

A similar model is provided by Schein (1985). Schein's (1985) model, together with a modification of this model provided by Hatch (1993) is provided in Figure 3.3 for comparison.

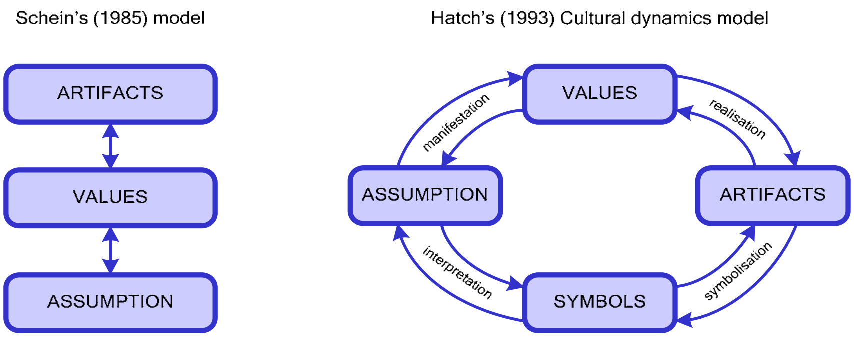

Figure 3.3 Schein and Hatch's models of culture

Hofstede *et al.* (1993) described values as the individual's personal preferences in work and life-related issues, and practices as descriptive perceptions by the employee of aspects of the work environment or actual work situation. When conceptualised in this manner, culture becomes more readily readable.

The cultural web (more like a cultural flower) developed by Johnson (1992, in Tharp, 2005) is also instructive on the composition of culture (Figure 3.4).

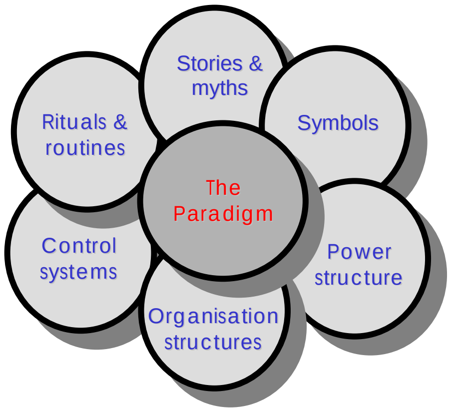

Figure 3.4 The cultural web [Source: Tharp (2005)]

Generally, an investigation of organisational cultures involves examining these practices, as well as the values and underlying assumptions that inform these practices (Hampden-Turner, 1994). However, emphasis on values and practices vary from study to study, with implications for the research questions asked. For instance, whereas an emphasis on practices will lead to the pursuit of '*what is?*' questions, an emphasis on values will lead to '*why?*' and '*what ought to be?*' questions (Hofstede, 1997).

In many past investigations, the emphasis has been on values and basic assumptions (Ankrah *et al.*, 2005c). Although values and basic assumptions are critical aspects of organisational culture, it has been empirically shown that organisations show more differences in their practices than in their values (Hofstede *et al.*, 1990; Hofstede, 1997; van den Berg and Wilderom, 2004). As expressed by van den Berg and Wilderom (2004), organisational culture can be better defined by organisational practices, and as a result can be derived from existing practices within an organisation, department, or work unit. Smith (2000) also argued for this perspective by asserting that the conventional view of culture, which centred on notions of shared values and beliefs was inadequate, instead calling for a strongly operational perspective on organisational culture "as embodied in the organisation's structures, mechanisms and practices." These represent culture in action and are more credible reflections of the organisation's culture than statements of values and beliefs which may be out of step with culture as implemented (Smith, 2000). Taken together, these arguments lead to the conclusion of Christensen and Gordon (1999) that consistent and widespread practices are reflections of organisational culture. Approaching culture through the study of organisational practices is advantageous because practices are more readily observable and measurable and can thus be compared across companies and can be directly related to individual and organisational performance (Christensen and Gordon, 1999). This approach is also consistent with Fellows and Lui (2000) and Wilson (1999) who argued that behaviour provides the active and dynamic expressions of culture and therefore provides data through which culture may be studied.

The implication this has for defining organisational culture so that it can be operationalised and employed in a framework for assessing the culture of CPOs, is that rather than focusing so much on values, the emphasis must be on practices. This argument is consistent with the definition proposed previously in which organisational culture is seen as being embedded in the solutions employed by CPOs in dealing with fundamental problems. 'What is?' questions are therefore appropriate in this research context to identify and draw out the practices or solutions that CPOs have evolved for dealing with their problems. The values and underlying assumptions that govern these practices or solutions can subsequently be inferred from these.

3.3.3 Diagnosing culture

Hampden-Turner (1994) and Denison and Mishra (1995) have argued that if necessary and within certain limits, organisational culture is measurable and describable. Diagnoses in this regard may be classified as being either qualitative or quantitative.

3.3.3.1 Qualitative approaches to diagnosing culture

Qualitative methods have been the traditional approach adopted in classical anthropological studies of culture which have sought to describe as empathetically and as comprehensively as possible why and how members of the culture go about their business. They employ ethnomethodological methods which generally involve protracted periods of living within the group and gathering data from within by interacting with people in as natural a manner as possible and by observing the behaviour of the subjects unobtrusively (Columbia Encyclopedia, 2005), and where appropriate, by the analysis of documents. They are fundamentally interpretive (Geertz, 2001). Schein (1985) prescribed one such method, referred to as "clinical iterative" interviewing, for assessing organisational cultures.

Such ethnomethodological studies offer a very practical way of assessing organisational culture and allow in-depth analysis to be undertaken. They enable the researcher to capture very comprehensively, the 'language' and 'meanings' of the organisation with minimal bias on the outcome of the investigation. Such studies inevitably raise, as pointed out by Hofstede (1997), questions of reliability (would another observer have perceived the same phenomena?) especially as the point of reference is always the researcher's own culture, and questions of generalisability (how does this case help to understand other cases?). Whilst ethnomethodological approaches are useful in the discovery of values and underlying assumptions of people (the essence of culture), it has been shown that these values and underlying assumptions are insensitive to differences between organisations within the same national culture (Hofstede *et al*., 1993; Delobbe *et al*., 2002). Moreover such aspects, which frequently exist at an unconscious level, are difficult to quantify (Cooper, 1998; Columbia Encyclopedia, 2005). Although the methodology may be appropriate for the bespoke diagnosis of the culture of an individual organisation, it offers little help in comparative studies as the parameters vary from organisation to organisation. It also has the disadvantage of being very time intensive, making its application in research constrained by time considerations, impractical. Although anthropological researchers have favoured such qualitative methodologies, these shortcomings have led to the pursuit of more quantitative assessments of culture involving the use of questionnaire surveys.

3.3.3.2 Quantitative approaches to diagnosing culture

Quantitative approaches rely on 'hard' data and Hofstede (1997) described such studies as "few and far between and not necessarily very convincing." Such studies have the advantage of reliability (independence of data from the researcher), and stability of the instrument over time, thus allowing the pursuit of longitudinal studies if necessary (Hofstede, 1997). As culture is a 'soft' characteristic, the problem this poses is the extent to which culture constructs can be 'hardened' to provide empirical referents that can be measured. It has been argued that one way to assess it is through the perceptions of individuals who function within the culture (Hofstede *et al.*, 1993). Several examples exist of efforts that have been made to operationalise constructs of organisational culture to facilitate an empirical assessment with the aim of giving a describable sense of the culture of an organisation (cf. Hofstede *et al.*, 1993; Cooke and Szumal, 2000; Ashkanasy *et al.*, 2000).

An assessment of constructs of culture requires the identification of aspects important to culture just as an assessment of forces will consider such aspects as magnitude and direction (Hofstede, 2001). These aspects are referred to as *dimensions* of culture, and 'hardening' the construct of organisational culture involves the identification of these dimensions of organisational culture and developing empirical referents around these dimensions that can be measured. Various dimensions abound in the literature on organisational culture, and as can be seen from Table 3.2, various researchers refer to different dimensions depending on what is considered important in the culture being studied, and whether the focus is on values or practices.

Table 3.2 Dimensions of organisational culture

	Cottle (in Abu Bakar, 1998)	Taylor & Bowers (1972)	Eldridge & Crombie (1974)	Deal & Kennedy (1982)	Schein (1985)	Harrison (in Graves, 1986)	Quinn (1988)	Hall & Hall (1990)	Thompson (1993)	Handy (1993;1995)	Trompenaars (1994)	Hofstede (1997)	Trompenaars & Hampden-Turner (1997)	Gesteland (1999)	Sonnenfield (in McNamara, 1999)	Ngowi (2000)	Cooper (2000)	DETR (2000)	Hagberg & Heifetz (2000)	Low & Shi (2001)	Hofstede (2001)	Serpell & Rodriguez (2002)	Barthope (2002)	Fellows & Lui (2002)	Svensson & Wood (2003)	Phua & Rowlinson (2003)	Skitmore *et al.* (2004)	Erez & Gati (2004)	Mullins (2005)
People																													
Calibre of employees										✓					✓														
Dealing with uncertainty										✓		✓									✓								
Relation to authority or hierarchy												✓	✓			✓					✓								
Power structures																													✓
Sense of equality																					✓								
Concern, commitment & morale							✓		✓																				
The primacy of human resources		✓																											
Humanity's relationship to nature					✓																								
Nature of reality & truth					✓																								
Nature of human nature					✓																								
Nature of human activity					✓																								
Nature of human relationships					✓																								
Individualism or groupism					✓					✓	✓										✓								
Characteristics of role relationships					✓																								
Space orientation					✓																								
Time orientation	✓				✓			✓													✓								
Concepts of masculinity & femininity																✓					✓								
Cooperative behaviour																										✓			
Behaviour & rules for behaviour				✓					✓													✓	✓	✓					✓
Integrity perception									✓																				
Ethics																									✓				
Health and safety																	✓												
Language																								✓					
Relationship between management & staff									✓																				
Attitudes towards work & others											✓														✓				
Processes and systems																													
Selection & succession						✓				✓					✓														
Control & coordination						✓				✓																			
Task organisation						✓				✓																			

	Cottle (in Abu Bakar, 1998)	Taylor & Bowers (1972)	Eldridge & Crombie (1974)	Deal & Kennedy (1982)	Schein (1985)	Harrison (in Graves, 1986)	Quinn (1988)	Hall & Hall (1990)	Thompson (1993)	Handy (1993;1995)	Trompenaars (1994)	Hofstede (1997)	Trompenaars & Hampden-Turner (1997)	Gesteland (1999)	Sonnenfield (in McNamara, 1999)	Ngowi (2000)	Cooper (2000)	DETR (2000)	Hagberg & Heifetz (2000)	Low & Shi (2001)	Hofstede (2001)	Serpell & Rodriguez (2002)	Barthope (2002)	Fellows & Lui (2002)	Svensson & Wood (2003)	Phua & Rowlinson (2003)	Skitmore *et al.* (2004)	Erez & Gati (2004)	Mullins (2005)
People management									✓																				
Support for employees																				✓									
Management systems & philosophies									✓							✓													
Discussion, participation & openness					✓		✓			✓																			
Decision-making practices		✓							✓													✓							
Decisiveness, direction & goal clarification				✓			✓																						
Routine & rituals																													✓
Team focus																												✓	
Attention to detail																												✓	
What management pays attention to & rewards or sanctions				✓		✓				✓									✓										
Motivational conditions		✓																											
Dealing with conflicts																✓													
Structure			✓						✓																				✓
Normative or pragmatic												✓																	
Bureaucratic or unsystematic & patrimonial roles			✓																										
Information management																													
Measurement, documentation & information management							✓																						
Information systems									✓																				
Communication flow		✓																											
Communication									✓											✓		✓					✓		
Control																													
Degree of centralisation						✓				✓																			
Degree of formalisation						✓				✓																			
Sources of power & influence						✓				✓																			
Continuity, stability & control							✓																						
Parochial or professional												✓																	
Open or closed system												✓																	
Control systems																													✓
Loose/tight or overt/suppressed control			✓									✓																	

	Cottle (in Abu Bakar, 1998)	Taylor & Bowers (1972)	Eldridge & Crombie (1974)	Deal & Kennedy (1982)	Schein (1985)	Harrison (in Graves, 1986)	Quinn (1988)	Hall & Hall (1990)	Thompson (1993)	Handy (1993;1995)	Trompenaars (1994)	Hofstede (1997)	Trompenaars & Hampden-Turner (1997)	Gesteland (1999)	Sonnenfield (in McNamara, 1999)	Ngowi (2000)	Cooper (2000)	DETR (2000)	Hagberg & Heifetz (2000)	Low & Shi (2001)	Hofstede (2001)	Serpell & Rodriguez (2002)	Barthope (2002)	Fellows & Lui (2002)	Svensson & Wood (2003)	Phua & Rowlinson (2003)	Skitmore *et al.* (2004)	Erez & Gati (2004)	Mullins (2005)
Control or influence of lower levels		✓																											
Technology																													
Technological readiness to change		✓							✓																				
Technology			✓																										
Business focus																													
Growth, external support & resource acquisition							✓																						
Profit/impact, productivity & accomplishment							✓																						
Process or results orientation												✓																	
Employee or job/task orientation												✓	✓																
Outcome orientation																												✓	
Strategies									✓																				
Target orientation									✓																				
Deal or relationship focus														✓															
Risk-taking				✓																								✓	
Client or market focus									✓																				
Reaction of suppliers & customers									✓																				
Learning and innovation																													
Innovation									✓							✓				✓								✓	
Insight, innovation & adaptation							✓																						
Learning																				✓									
Speed & degree of feedback				✓																									
Environment																													
Sustainability																		✓											
Environmental awareness																		✓											

There are several research instruments that have been developed for measuring culture based on these dimensions of culture (cf. Delobbe *et al.*, 2002, Ashkanasy *et al.*, 2000; Cooke and Szumal, 2000). Hofstede's Value Survey Module (VSM) (Hofstede, 1984) and the Quinn and Cameron 'Competing Values Framework' (CVF) (Quinn, 1988) are common examples frequently encountered in the literature.

When dealing with a multitude of dimensions, typologies are employed as an alternative to provide a simplified means of assessing cultures. Typologies describe a number of ideal types of culture, each of them easy to imagine, against which the culture being assessed is compared (Hofstede, 2001). Typologies are used as metaphors and have mainly been utilised in studies of organisational culture for their ability to communicate easily a sense of what the culture is. Table 3.3 outlines various typologies commonly found in the literature on culture. The application of typologies in cultural studies is problematic although they are easier to comprehend and communicate. The main flaw in their use is the inability of real cases to correspond with any single typology (Handy, 1995; Hofstede, 1997). The tendency then has been for researchers to associate organisations with the dominant typological orientation (cf. Handy, 1995). In actual fact, organisations have a hybrid of typologies (Handy, 1995; Schneider, 2000) and classification as one or other culture may be misleading. A general caveat in the use of typologies is the fact that they are metaphors and are meant to serve illustrative purposes only. Over-stretching meanings may lead to misrepresentation of organisational cultures.

Table 3.3 Typologies of culture

Harrison (in Graves, 1986)	Quinn (1988)	Handy (1993; 1995)	Hofstede (1997)	Sonnenfield (in McNamara, 1999)	Trompenaars and Hampden-Turner (1999)	Schneider (2000)
Power	Clan	Club	Families	Club	Family	Control
Role	Hierarchy	Role	Pyramids	Fortress	Eiffel tower	Collaboration
Task	Market	Task	Markets	Academy	Market	Competence
Atomistic	Adhocracy	Person	Machines	Baseball team	Adhocracy	Cultivation

Dimensions are therefore the preferable option in assessing organisational culture. However, as demonstrated by Hofstede (1984), a weakness in the use of these dimensions is the fact that they are subject to the influence of the researcher and tend to be value laden. This implies that dimensions developed in one national or industry context may not necessarily be appropriate in another setting. However, where appropriate dimensions can be identified, they represent the most realistic way of undertaking cross-cultural comparative studies. Typologies may be used to compliment these dimensions, but for this to be done, cases must be scored unambiguously using indexes and scales and sorted into clusters with similar scores. These clusters can then form the basis of the typologies (Hofstede, 1997).

Quantitative approaches permit data collection across a large number of organisations, and this facilitates cross-organisational analysis. Their usefulness in this direction therefore makes them worth considering when contemplating comparative studies.

Just as in the case of the qualitative approaches, these quantitative approaches have limitations. It has been argued in many quarters that they are at best superficial, not giving enough depth to aid the understanding of the underlying assumptions that define culture. It is believed that most questionnaire measurements of culture have actually only provided an assessment of organisational climate as opposed to the actual organisational culture (Cooper, 1998; Hofstede, 2001). However as argued previously, climate is itself a useful way of assessing culture (Payne, 2000). Such quantitative studies, irrespective of the measuring approaches and instruments, make culture discussible (Hale, 2000) and provide an opportunity to maximise the values of systematisation, repeatability and comparability.

3.3.3.3 An alternative approach to diagnosing culture

To circumvent the limitations of either approach, it is also possible to synthesise the two approaches by starting with a qualitative orientation, followed by a quantitative verification (Hofstede *et al.*, 1990) or *vice versa*. Hofstede *et al.*'s (1990) application of in-depth interviews and "paper-and-pencil" surveys, and a similar study reported in van den Berg and Wilderom (2004) are instructive, and provide examples of what can be achieved through a synthesis of qualitative and quantitative methodologies. Within construction management research, the evidence from literature suggests that such research on organisational culture, which incorporates both qualitative and quantitative elements, is lacking. Research in this vain is not only feasible, as seen in Hofstede *et al.* (1990) and van den Berg and Wilderom (2004), but also necessary.

3.3.4 Implications for current research

It is clear from the literature that the phenomenon of culture does exist and does operate at the organisational level, implying that an investigation into this phenomenon within the context of a CPO is a viable line of enquiry. The review of literature on culture has also demonstrated that there is sound basis for hypothesising that culture does have an effect on performance outcomes. The theoretical arguments presented of how culture may be conceived are summarised in Figure 3.5. This figure captures the different conceptualisations of culture from an anthropological and organisational perspective, and the different types of enquiry that the different conceptions lead to. It also shows the composition of culture which is split between practices and values/underlying assumptions, with practices aligned with the "culture as variable" perspective and values/underlying assumptions more closely aligned with the "root metaphor" perspective (Smircich, 1983). According to Smircich (*ibid*) organisational researchers aligned with the "culture as variable" perspective tend to be more concerned with prediction, generalisability, causality, and control. These are key issues with which this research is concerned especially as the aim is to examine cultures across construction projects and explore their relationships with outcomes. A "culture as variable" perspective (*ibid*) is thus appropriate in this research.

It can be argued that this mode of enquiry should be a precursor to any enquiry into the more fundamental issues of meaning and the processes by which organisational life is possible which is the concern of those researchers aligned with the "root metaphor" perspective (Smircich, 1983). In other words, before starting to look for underlying assumptions or meanings and trying to draw cognitive maps it is important to know firstly what the culture is, as manifested in practices.

As shown in Figure 3.5 which summarises the implications for questions asked and sources of cultural data, the research will focus on '*what is?*' questions, to draw out responses on existing practices, as opposed to '*what ought to be?*' or '*why?*' questions which lead to responses on preferences and values. In asking these 'what is?' questions, the research will examine those solutions adopted in addressing problems as manifested in organisational structures, information and control systems, organisational processes, behaviours, myths, legends, stories, and charters, among other aspects (Taylor and Bowers, 1972; Schein, 1985; Thompson, 1993).

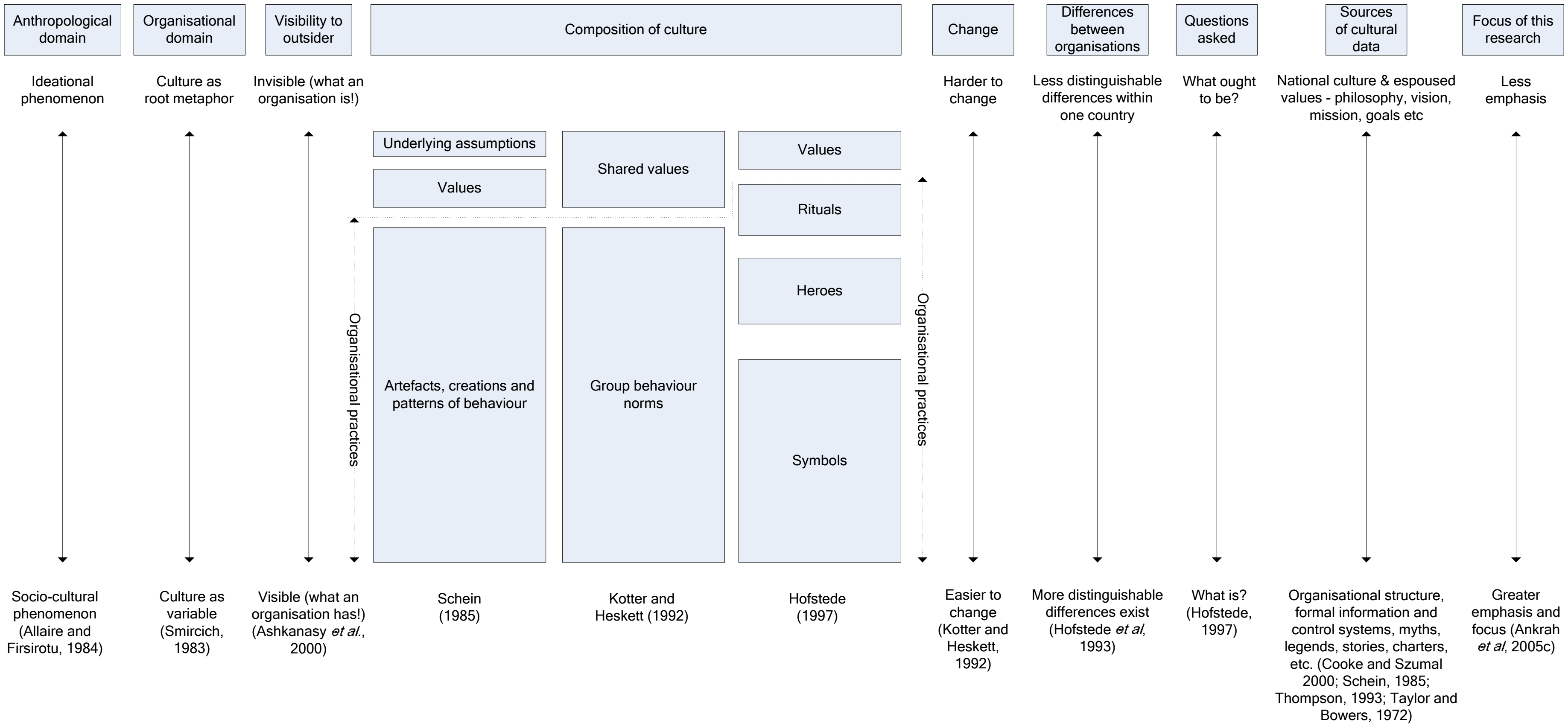

Figure 3.5 Summary of literature and implications for investigating the culture of CPOs

3.4 CULTURE WITHIN THE CONSTRUCTION INDUSTRY

According to Newcombe (2003), the stakeholders within the project coalition interact with the project in two primary arenas; cultural and political, with the cultural arena represented by the ideology or shared values of the project participants. Cultural issues are therefore always at the fore (Ofori, 2000). In trying to give more flesh to this cultural arena Abeysekera (2002) defined culture within construction to be about the "characteristics of the industry, approaches to construction, competence of craftsmen and people who work in the industry, and the goals, values and strategies of the organisations they work in". In essence, culture within construction is about what is carried out, how and when it is done, who is involved and why certain things are done the way they are. These perceptions of culture as applied to construction are consistent with the earlier generic definitions of culture posited by the likes of Bodley (1994). The insight derived from Abeysekera (2002) is particularly useful as it fulfils the need to see culture through the eyes of construction industry members.

As demonstrated from the discussion so far, culture must be an important consideration for every organisation in every industry. In construction, this becomes more critical because of the nature of contracting, internationalisation of procurement, joint venturing, and the transfer and implementation of innovative philosophies and practices such as partnering, JIT management, Supply Chain Management and TQM from relatively more successful industries such as manufacturing and retail (Riley and Clare-Brown, 2001). As aptly stated by Hall (1999), the project-based arrangements that characterise the production of the built environment make the potential impact of culture even more pronounced than in any other industry.

A number of important contributions have been made in support of this argument. Maloney and Federle (1990) for instance pointed out the fact that the culture of a construction organisation was a primary determinant of performance within that organisation. It was also found to have an influence on the degree of participation and openness, approaches to decision-making, the quality of communications and working relationships (Hall, 1999; Low and Shi, 2001; Skitmore *et al.*, 2004), rendering otherwise successful managers and organisations ineffective and frustrated when working across cultures. They demonstrated that any organisation that wanted to carry out or manage a construction project successfully in another country had to understand the culture of the host country clearly. According to Ofori (2000) culture had an influence on the choice of foreign parties in joint ventures. Ngowi (2000) also showed the difficulties associated with the implementation of such foreign philosophies as TQM in developing countries, with their successful implementation usually requiring changes to the shared assumptions, frames of reference and understandings that most organisations have developed. This is because these philosophies and practices are invariably embedded with their own set of cultural beliefs, norms, values and assumptions (cf. Riley and Clare-Brown, 2001). Similar findings were also reported in Pant *et al.* (1996), although in this case the emphasis was on the incompatibility of imported project organisational structures with local attitudes and values in Nepal.

Culture has also been found to be a potential source of competitive advantage by some researchers, especially in the face of increasing globalisation. Through a survey of Australian contractors working internationally, Jefferies *et al.* (2002) found cultural awareness to be an element of competitive advantage.

The cases of the Bangkok Expressway extension project (Handley, 1997; Masaoka, 2003) and the rebuilding of the Croatian motorway from Zagreb to

Split following years of war (Eaton Consulting Group Inc., 2002), also provide further evidence that besides institutional gaps, cultural gaps hamper the efficient execution of projects. In the former case for instance, cultural differences between the Japanese contractor Kumagai Gumi, their local partners, and the client influenced project delivery and eventual outcomes. In the latter case also, which involved nine different nation-state cultures and two starkly different corporate cultures, the human interaction elements tended to detract focus from either schedule or budget.

At the project level, Soetanto *et al.* (1999) also found that quality of interrelationships between project participants ultimately determines overall project performance and individual participant performance. Although these interrelationships were not examined within the context of research into culture, it is reasonable to infer that culture must be an important factor. It also has an influence on the propensity for litigation (Fenn *et al.*, 1997; Phua and Rowlinson, 2003), and the attitudes and behaviours towards such aspects as health and safety (Cooper, 2000).

These influences can lead to positive or negative outcomes (Hampden-Turner, 1994; Handy, 1995), and to this extent culture merits serious consideration. However, research into these issues within the construction research community has been very limited and disparate (Ankrah and Proverbs, 2004). Whilst some industries have had the benefit of research drawing from the general principles and models espoused by culture researchers for industry-specific research, for instance food retail (Ogbonna and Harris, 2002) and manufacturing and services (Guest *et al.*, 2003), quite a significant body of the existing literature on culture in construction tends to be anecdotal. Barthorpe *et al.* (2000) for instance presented a profile of the UK construction industry, citing the hierarchical structure, wage structure and confrontational nature of contracting as factors setting the tone for the culture of the industry, but failed to produce any systematic research to justify these assertions or to show the extent to which these factors impact the culture and output of the industry.

This and many other literature including renowned construction industry reports such as Latham (1994) and Egan (1998) have highlighted the more negative aspects of culture within the construction industry, in particular traits such as being litigious, antagonistic, dangerous and dirty, sexist and discriminatory (cf. Latham, 1994; Egan, 1998; Barthope *et al*., 2000; Duncan *et al.*, 2002; Loosemore, 2002; Rooke *et al*., 2004). This has fuelled the negative stereotyping of the culture of the construction industry. Whilst culture has a wider scope than suggested by these stereotypes (cf. Abeysekera, 2002), there is little by way of systematic research into culture to show what the full extent of the culture of the industry is, and to examine empirically, the extent to which it affects the output of the industry. As Barthorpe *et al*. (2000) suggested, this provides a fascinating field of study of the industry within the context of culture.

3.5 CULTURE RESEARCH IN CONSTRUCTION – A REVIEW

Despite the established need for research in this field, the state of research on culture in the construction industry is generally still at the pioneering stage (Serpell and Rodriguez, 2002). The main focus of research into the role and impact of culture in construction is reported by Fellows and Seymour (2002) as being two-fold, namely:

- “National differences as they affect efforts to change industry practice in the country concerned or as they affect international collaboration; and

- Occupational and organisational differences, how they affect receptivity to new practices and technologies, and inter-firm collaboration."

Other issues being covered in research, though to a lesser extent, include the linking of culture with power and the exploration of negative effects of cultural homogenisation, and methodologies associated with research in culture (Fellows and Seymour, 2002).

3.5.1 Cross-cultural research

Indeed a significant proportion of the research uncovered on culture in construction is on national differences and their potential effects on project delivery. For instance Abu Bakar (1998) studied the extent to which Western and Eastern values have shaped the organisational culture and management practices of Malaysian contractors, and Hall (1999) looked at the challenges different cultures posed to expatriate staff working abroad and the training and support made available to them by their organisations. The cultural dimension was found to be an important factor whose effects were difficult to quantify but indisputable, and that inadequate strategic approaches were adopted by construction firms in dealing with this dimension. The research adopted both quantitative and qualitative approaches.

Pant *et al.* (1996) provided an interesting piece of research on culture also addressing the effects of national differences in cross-cultural working environments. This was a quantitative study that sought to compare the bureaucratic orientation of 'Western' managers and Nepalese managers, and the bureaucratic orientation of project-based and non project-based organisations. Although bureaucracy represents a significant aspect of culture, it is only one of several dimensions along which differences may exist. As the research provided no theoretical basis for focusing on bureaucratic orientation it is open to the criticism of being too narrow, although some might argue like Geetz (1973, in Keesing, 1974) that narrow is better. A similar study was also conducted by Phua and Rowlinson (2004), although in this case, the study was more firmly grounded theoretically. Drawing on social identity theory, this study focused on individualist-collectivist orientations of Chinese and Anglo-Saxon senior managers and the effects of these orientations on inter-organisational differentiation and consequently on in-group favouritism and out-group discrimination.

Another study of culture within this same context is reported in Skitmore *et al.* (2004). This was in fact a report of two studies conducted simultaneously examining cultural diversity among 'Far Eastern' and 'Anglo' construction project participants and its impact on intercultural communication. Ngowi (2000) also found that culture had a profound influence on the implementation of management philosophies and practices (like TQM) which were developed in other contexts, because these management philosophies and practices were already embedded with cultural beliefs, norms, values and assumptions that were not compatible with the new context into which they were being introduced. Unlike the previous studies discussed, this was a qualitative study delving into TQM implementation and the cultural barriers in Botswana. Abeysekera (2002) developed a conceptual framework to aid understanding of the nature of culture in the international construction context, through literature surveys and interviews. There are other similar cross-cultural studies of this same ilk (cf. Low and Shi, 2001). Although all these studies are conducted in different countries and address different issues, they demonstrate abundantly that there are insights that can be drawn about cultural diversity and its effects in a multi-cultural project context. There are many lessons for managing multi-cultural projects. Many of such cross-cultural studies rely on frameworks developed by the likes of Trompenaars and Hampden-Turner (1997) and Hofstede (2001) as the basis for evaluating cultural differences, implying that they automatically retain the weaknesses inherent in those frameworks some of which are identified in Hofstede (2001).

3.5.2 Occupational and organisational differences

Among those studies relating to occupational and organisational differences, notable pieces of research undertaken include that of Serpell and Rodriguez (2002) which presented the findings of a research investigating the critical cultural elements of construction firms and the strategic action areas that could potentially influence these elements. This was a qualitative study based only on one case study raising questions about the generalisability of the findings. Other researchers who have also favoured this qualitative ethnographic approach which is rooted in anthropology include Dainty *et al.* (2002), Duncan *et al.* (2002), Loosemore (2002), Rooke and Seymour (2002), and Rooke *et al.* (2004). These approaches typically involve participant observation or in-depth interviews where the main aim is for the researcher to either learn the culture in the same way that members of that culture do or by having in-depth discussions with informants (Rooke and Seymour, 2002). As has been noted previously, these approaches do not facilitate comparison of cultures across organisations. Different researchers would also observe and draw different conclusions, making the findings difficult to generalise. Moreover, according to Rooke and Seymour (2002) there are very few of such ethnographic studies, and even where they exist, they tend to be theoretical, and as a result fail to describe the main features of the construction industry culture.

In trying to overcome these shortcomings of the qualitative approaches, a number of attempts have been made at assessing the cultures within construction quantitatively. Here also, the research is limited. The limited quantitative research undertaken in this area have mainly involved the direct application of generic organisational behaviour frameworks such as the

Quinn (1988) 'Competing Values Framework' shown in Figure 3.6 (cf. Maloney and Federle, 1990; Thomas *et al.*, 2002; Rameezdeen and Gunarathna, 2003; Lorenz and Marosszeky, 2004; Zhang and Liu, 2006; Zuo and Zillante, 2006), or the direct application of national culture survey frameworks such as the Hofstede (2001) 'Value Survey Module' (cf. Root, 2002) to the study of culture within construction organisations and project organisations. Other researchers have resorted to an arbitrary choice of dimensions of culture (cf. Ankrah and Langford, 2005).

The main feature of all these frameworks is that they rely on *a priori* set of dimensions such as those shown in Figure 3.6, and they utilise questionnaire surveys to collect data. Whilst they provide a simple and practical tool for diagnosing culture, they do not facilitate the study of relationships and dependencies that exist between culture and its determinants and consequences. In applying these frameworks, construction management researchers have borrowed the dimensions from these frameworks and employed them in collecting data without considering the relationships and dependencies as pointed out above. This is a significant limitation of this approach.

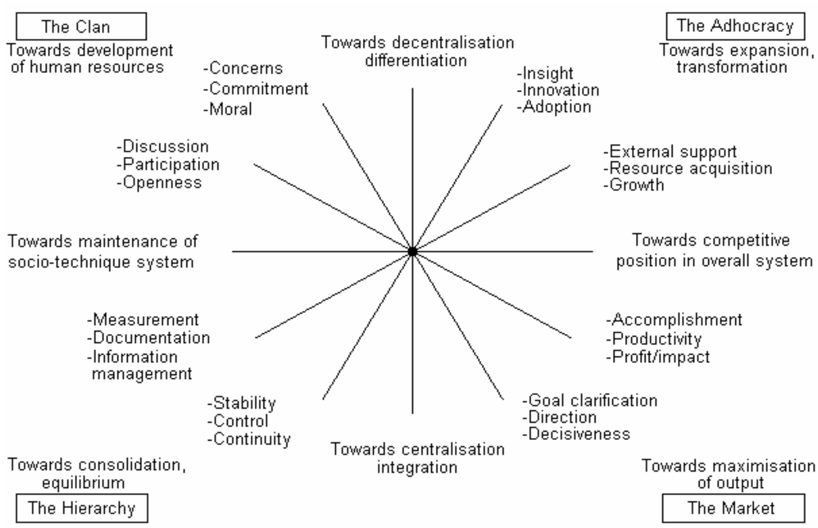

Figure 3.6 Competing Values Framework: An example of frameworks being used in 'culture-in-construction' research [Source: Quinn (1998)]

Schein (2000) has also described this use of *a priori* set of dimensions as objectionable as it does not allow the net to be cast widely enough. However it is also a fact that without a specified set of dimensions, and without the strategic focus they provide (Kotter and Heskett, 1992 in Schneider (2000)), it will not be possible to undertake comparative studies. Indeed the studies described above are very instructive to the extent that they make culture discussible and comparable along certain specific dimensions.

Another major criticism with the use of these frameworks is the fact that all existing frameworks are context specific (Hofstede, 2001; Ankrah *et al.*, 2005c), and since none of these frameworks were developed within a construction context, it can be argued that the dimensions they propose may not reflect the realities of the CPO which has characteristics significantly different from other organisations. In short, these frameworks may fail to reveal the culture of project organisations along relevant dimensions of culture.

A very useful framework developed with the construction project context in mind is that in Kumaraswamy *et al.* (2002). This framework focuses on the determinants of project culture and incorporates the peculiarities of the construction industry making it possible to understand how the culture within a CPO develops. Unlike the other frameworks applied in construction management research, it does not however specify dimensions along which the culture that develops is likely to manifest and therefore provides limited help in diagnosing culture.

3.5.3 Other related research

A number of studies have also targeted specific aspects of culture. Nicolini (2002) for instance developed the concept of "project chemistry". Lui (2002) explored "harmony" within the context of construction projects. Although the discussions of appropriate research approaches for investigating cultural phenomenon like harmony are insightful, Lui (*ibid*) failed to demonstrate these in practice. Kadefors (2004) examined trust in project relationships in an article that, though insightful, was also fundamentally theoretical. There are also the usual collection of articles purporting to offer suitable frameworks for culture research in construction (Kumaraswamy *et al*., 2002), those discussing research methodologies (cf. Tijhuis, 2001), and those which are in essence just reviews (cf. Barthorpe *et al*., 2000; Fellows and Lui, 2002).

These articles together represent the range of studies focusing on the national, organisational and project perspectives of culture and how potentially, they affect attitudes and approaches to work and relationships on projects. These studies reflect the disparity in this research domain. They also reflect the limited research into the phenomenon of culture and its potential influence on the construction process. Insightful though these studies are, they still leave many fundamental questions unanswered. From a project perspective, questions relating to the relevant dimensions of culture to be assessed in research, appropriate and rigorous research approaches, what the culture of the industry is, and the relationship between culture and project outcomes *inter alia* are all not fully addressed.

3.6 IMPLICATIONS FOR FURTHER RESEARCH

The paucity of research on culture in construction highlighted by the likes of Hall (1999) and Phua and Rowlinson (2004) implies a wide scope of possibilities for further research in this genre. Fundamentally, research needs to be undertaken to reveal the cultural orientation of construction project organisations. Such studies must be on-going in view of the transient and dynamic nature of culture (Svensson and Wood, 2003). Findings from such studies will throw light on some of the subtle motivations that shape the behaviour of participants and the nature of the industry. Such studies will also make it possible to assess the changes in culture over time. As pointed out by Maloney and Federle (1990) and Serpell and Rodriguez (2002), one of the possible benefits of measuring culture is that it makes it possible to assess the success or otherwise of various interventions to change culture. For this to be done, there is a need to develop an appropriate and theoretically sound framework, incorporating dimensions of culture that are relevant to the construction project context. As has been shown from the literature reviewed, the existing frameworks are inadequate in this respect.

There is also potential for investigating the impact of culture on performance outcomes especially at the project level. An appreciation of how culture, in whatever form; national, organisational or occupational, affects the competitiveness, profitability and performance of project organisations within the industry will help with the process of implementing changes in culture and organisational structures. Since such research is generally lacking, as demonstrated by the review, studies exploring such relationships will undoubtedly be beneficial to the industry. According to Tijhuis (2001), construction industry participants need to become more aware of the importance of this phenomenon and its manifestation and impact "on the process and product of construction business." Tijhuis (2001) calls for stimulation of this awareness through further research based on the continuous improvement and adaptation of existing frameworks.

Xiao and Proverbs (2003) pointed out that the overall performance improvement agenda of the construction industry requires improvements in products (right first time), the delivery (in terms of quality, cost and time), and the sustainable development of construction firms (profitability and competitiveness). To the extent that culture directly or indirectly, as implied by the review, has a significant influence on all these elements and by extension the performance of the industry as a whole, culture merits systematic research to explore the nature and extent of such influence.

3.7 SUMMARY

The consensus of views, established through the review of culture, suggests that culture comprises the values and system of meanings peculiar to a group of people, that are learned and shared by all the individuals in the group through dealing with the basic problems of life and through their interaction with the contextual factors relating to the environment in which they live. Culture therefore has the ability to shape the behaviour of, not just individuals, but groups of people as in organisations, industries and countries. This innate ability of culture to shape behaviour has particular relevance for the construction industry because of the industry's peculiar nature of contracting and product delivery, requiring the cooperation of a myriad of participants who sometimes have different and conflicting objectives. Unfortunately, for a long time, its importance has been understated and references made about its influence have been mainly anecdotal. Although many of the inexplicable construction industry ills have been attributed to this phenomenon, not much has been shown by way of formalised research into culture to show the extent of its impact.

This trend has been changing over the past decade, particularly with the publication of landmark reports such as Latham (1994) and Egan (1998) which made strong cases about the potential of culture to undermine performance. Together with the successes of other industries, which the construction industry has sought to emulate, these reports have raised awareness of the importance of culture in construction. This growing awareness is evidenced by the increasing research interest and publications on culture and related issues, though much of this remains anecdotal.

Research on culture in construction has been focused on national differences as they affect industry practice and international collaboration, and occupational and organisational differences as they affect receptivity to new practices and inter-firm collaboration (Fellows and Seymour, 2002). However, there is still relatively a lot more to be done. Fundamental questions of what the cultures of CPOs are and what impacts these cultures have on performance outcomes are yet to be investigated. As pointed out by Tijhuis (2001), construction industry participants need to become more aware of the importance of this phenomenon and its manifestation and impact "on the process and product of construction business." This can only be achieved through research, and for this to be undertaken it is necessary to develop appropriate frameworks based on continuous improvement and adaptation of existing frameworks (Tijhuis, 2001). The next chapter is devoted to the development of such a framework for this research, and indeed for any other systematic research into the culture of the construction industry; research that is essential in the quest for performance improvement in the construction industry.

CHAPTER 4: CULTURE AND PERFORMANCE – A CONCEPTUAL FRAMEWORK

4.0 INTRODUCTION

It was shown in the preceding chapter that there are grounds for hypothesising that culture does have an impact on performance, and that this relationship can be captured empirically. In order to investigate systematically this empirical relationship between culture and performance, it is necessary to have a conceptual framework that brings together in a logical manner all the essential aspects to be investigated, and provides appropriate parameters and points of reference for investigating culture within a construction project context. This chapter focuses on the development of such a conceptual framework and on the development of empirical referents to aid the development of appropriate hypotheses, data collection and hypotheses testing. This chapter thus addresses the third objective of this research which was to develop a conceptual framework of the relationship between organisational culture and performance.

4.1 CONCEPTUAL MODELS

In trying to understand social systems, irrespective of the context, models are used (Hofstede, 2001). Models are considered as simplified designs for visualising objects, processes, systems or concepts too complex to grasp (Fellows and Lui, 1997). As indicated by Hofstede (2001), in this simplification process associated with the development of models, a certain level of subjectivity enters the process. This not withstanding, the model must capture and represent the reality being modelled as closely as practical and include the essential features of the reality whilst being easy to use (Fellows and Lui, 1997). Although models of organisational culture have been criticised for oversimplifying a complex phenomenon, it is also recognised that such models serve an important role in guiding empirical research and theory generation (Hatch, 1993).

An example of such a model showing how organisational culture impacts performance and satisfaction is provided in Robbins (1998) and is reproduced below for illustrative purposes (Figure 4.1). An examination of the elements labelled as objective factors in this model shows that they mirror some of the dimensions of culture listed in Table 3.2 (refer Chapter 3). An organisation can have a high or low orientation in respect of any of these dimensions, and these orientations will have implications for both performance and satisfaction.

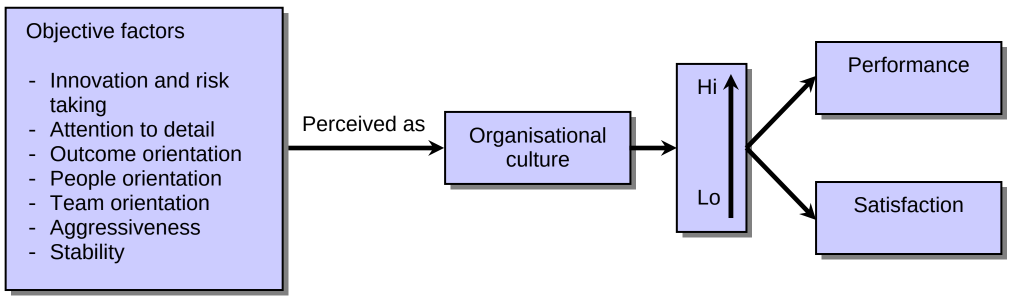

Figure 4.1 A conceptual model of the impact of culture on performance and satisfaction [Source: Robbins (1998)]

This model is very instructive to the extent that it highlights behaviours or practices associated with organisational culture and the consequences as reflected in performance and satisfaction. However its utility is limited by the choice of objective factors which need to be reconsidered to make such a model more applicable to the construction project organisation (CPO) context. Moreover, in the development of such a conceptual model to provide a basis for this research into organisational culture and its impact on construction project performance, it is important to take account not just of what Cooper

(2000) described as the 'behaviour(s)' (captured in Figure 4.1 as objective factors) and 'consequence(s)' (captured in Figure 4.1 as performance and satisfaction), but also to take account of the 'antecedent states' (Cooper, 2000) associated with this organisational phenomenon. All these aspects are critical to understanding the cause and effect relationships and dependencies that exist between organisational culture, its context and consequences. In trying to develop a simple but practical tool for this empirical research, these three aspects are examined within a construction project context.

4.2 'ANTECEDENTS'

Organisational culture develops incrementally, evolving gradually over time (Meudell and Gadd, 1994) as the organisation contends with the various pressures arising from both internal and external sources. Reconciling these pressures sets the tone for jobs and cultures (Handy, 1993). It has been argued that the culture of CPOs needs to be examined against the background that they are in actual fact 'short life organisations' (SLOs) (Ankrah *et al.*, 2005b) and as such feel different pressures, and feel them differently from conventional organisations. Drawing from theory on SLOs (cf. Meudell and Gadd, 1994; Mullins, 2005) as well as theory from the traditional management views on culture and its determinants (cf. Graves, 1986; Kotter and Heskett, 1992; Thompson, 1993; Handy, 1993; Hampden-Turner, 1994; Mullins, 2005), the main determinants of the organisational culture within CPOs can be identified as broadly comprising recruitment strategies and the composition of the CPO, training initiatives, project characteristics, project manager and dominant groups, significant events, procurement approach, macro-culture, industry characteristics, location, and technology and primary function. These determinants are discussed in more detail below.

4.2.1 Recruitment strategy and composition of the CPO

From studies of typical SLOs, Meudell and Gadd (1994) found that rather than any other factors, the recruitment strategy was one of the two key determinants of the culture of the organisation. The way and manner in which people are screened and selected for employment influences the sort of people who are recruited and become members of the organisation, and the values and behaviour they bring to the organisation. If these values and behaviour fit in with the organisation, then it leads to a perpetuation of the culture, otherwise it could lead to conflict and/or changes (Graves, 1986; Handy, 1993; Mullins, 2005). Moreover as highlighted by Kotter and Heskett (1992), ideas or solutions that become embedded in a culture can originate from all members of the organisation. It can be argued therefore that the *composition of CPOs*, influenced by its recruitment strategy, will be crucial to its culture.

The composition of CPOs can be differentiated along lines of gender, ethnicity, age profile and educational levels. Statistics from the CITB estimates that women make up only 9% and ethnic minorities make up only 2% (CITB, 2002). In terms of age and available skills, although there has been a decline in the 16–29 year age range, possibly attributable to the economic downturn of the 1990s, the profile is still young, with about 46% having an NVQ-equivalent level 3 or above (Pearce, 2003). Different behaviours are possible where variations in employee profiles (such as number of female participants) exist within the CPO. With particular regards to females, it has been noted that beyond reasons of social equality, women possess attitudes and attributes that organisations need (Handy, 1994 in Barthorpe *et al.*, 2000). A more “female” culture in the construction industry has also been advocated for by Langford *et al.* (1995 in Barthorpe *et al.*, 2000). Some of the desirable characteristics of the feminine culture in the workplace are identified as the use of intuition and consensus, a stress on equality, solidarity, and quality of work life, resolution of conflicts by compromise and negotiation, caring, compassion, generosity, and sensitivity (Hofstede, 1997; Wilson, 1999). It has been noted also by Wilson (1999) that minority groups also possess such attributes. This seems to suggest that the greater the proportion of females or minority groups, the greater the likelihood of developing a culture that manifests these behaviours. However it has been established that, with a profile such as that described above, the culture of CPOs is skewed towards a "macho" young white male behaviour (Wilson, 1999; Barthorpe *et al.*, 2000; Serpell and Rodriguez, 2002). This is a situation that prevails widely across the construction industry. Moreover according to Wilson (1999), women in such male-dominated areas tend to adopt masculine traits.

4.2.2 Training initiatives

Another key factor identified by Meudell and Gadd (1994) as an important tool for cultivating a desired culture was training. This is echoed in Mullins (2005). Training initiatives can be used to transmit and embed in employees what is important and should be prioritised, what the goals and objectives of the organisation are, what the expected behaviour is, the relevant terminologies, what the various roles are and the extent of their responsibilities, and the communication networks (Meudell and Gadd, 1994). It can also be used to improve project leadership and management skills. With construction characterised by casual employment where employees often fail to identify with the project and its successful completion (Barthope *et al.*, 2000), and typically involving a myriad of participants who often have divergent objectives and cultures (Chua *et al.*, 1999; Hsieh, 1998), training is a useful way of re-orienting project participants.

4.2.3 Size and other project characteristics

In a typical organisation, increasing size leads to departmentalisation and/or "split-site" operations (Mullins, 2005). This is inevitably accompanied by communication and coordination difficulties, and necessitates the formalisation of mechanisms for communication, control and coordination, as well as the structure of the organisation. Decreasing size also has its impact. Handy (1993) describes size as being perhaps the single most important variable in determining the culture of an organisation. CPOs also vary in size and this is in relation to project scale, type, complexity and clients served. This has an influence on the composition of the CPO, who manages the project, the duration of the project, as well as communication networks, organisation structure, and control and coordination mechanisms. It is logical therefore to propose that in an industry where each project is unique, the different *project characteristics* will lead to different cultural orientations.

4.2.4 The industry characteristics

This determinant of culture considers the stability or dynamism, and standardisation or diversity of the environment and also takes into account threats and dangers in the form of take-overs, mergers, nationalisation and economic recessions (Graves, 1986; Kotter and Heskett, 1992; Handy, 1993). In order to be effective, organisations must be responsive to these external environmental influences (Mullins, 2005). Significant changes in the environment may require changes in the culture to avoid a long-term deterioration of economic performance. It can be argued that this influencing factor is independent of the project and all CPOs are affected by the state of the economic or business environment.

4.2.5 Significant events and procurement

Any organisation with history has a culture (Schein, 1985). This factor considers the reason and manner in which the organisation was formed, and the extent to which an organisation has had to be flexible, adaptable and sensitive. It also considers the merger history and managerial changes that have occurred in a firm (Handy, 1993). Crises, in the form of key events such as a merger, major re-organisation, new management, diversification into very different businesses or geographical expansion may bring in its wake, a change in culture (Kotter and Heskett, 1992; Mullins, 2005). Conversely, continued success leads to the emergence of a culture that reflects the vision or strategy that led to the success. The age of an organisation is therefore an important consideration. In the case of CPOs, history can be said to be limited, because of the project-oriented nature of the industry. However, to the extent that significant events, in the form of disputes and/or project management changes (cf. Low and Shi, 2001) can occur even during the relatively short project durations, cultural changes can result (Loosemore, 1998). For instance, a culture of mistrust, antagonism and conflict can develop following a dispute on a construction project site. It can be proposed therefore that when *significant events* such as disputes or project management changes occur, changes in the culture and the way a project proceeds can subsequently occur.

In modern procurement of construction projects, it is becoming popular to have arrangements which allow for partnering (relational contracting, serial contracting or alliancing), implying that though CPOs still remain SLOs, there is arguably, some history that informs the culture that prevails in the CPO. It has been argued elsewhere that through partnering, expertise is developed and knowledge is accumulated and transmitted from project to project (Packham *et al.*, 2003). The same argument can be made for an approach to work, an acceptable way of behaviour, an attitude, or more appropriately, a culture which develops from project to project and becomes pervasive. This culture is often associated with a spirit of collaboration, open interaction, trust, commitment, mutual advantage, learning, innovation and productivity (Cook and Hancher, 1990; Crowley and Karim, 1995; Drexler and Larson 2000; Naoum, 2003), and this contrasts sharply with the traditional culture of antagonism, conflict and disputes. It can be seen from this that the *procurement approach* is likely to have an impact on the culture of the CPO, with different procurement approaches leading to different cultures.

4.2.6 Technology and primary function

The technological processes and methods of undertaking work are determined by the primary function of the organisation (Mullins, 2005). Although the type of technology does not necessarily lead to the development of one or other culture, it is clear that certain technologies appear to be more suitable for certain cultures (Handy, 1993). In the construction industry, the bespoke nature of projects implies that the primary function and associated technology may be dependent on project characteristics as already discussed. However generally speaking, the technology adopted by an organisation is dependent on the industry in which it is operating. In this context therefore construction technology can be considered as being determined by the construction industry as a whole.

4.2.7 Dominant group

This factor concerns founders, leaders or dominant groups and includes such issues as the founders' values, philosophy and dominance, nature of ownership, and extent to which the organisation has been centralised since its inception (Kotter and Heskett, 1992; Handy, 1993; Mullins, 2005). Strong founders and strategic leaders are important in establishing organisational cultures that are both internally consistent and fit the environmental conditions (Kotter and Heskett, 1992). As mentioned before, ideas and solutions that become embedded in culture originate from various quarters within the organisation. However, more often than not, these ideas seem to be associated with leaders, particularly founders or other early leaders who articulate them as a vision, strategy or philosophy (Kotter and Heskett, 1992). Within the context of a construction project, the leaders are often project managers or the main contractor. Other dominant groups may also emerge, and where these are linked with particular occupations, the approach to work adopted by this occupation (their culture) may form the perspective from which this dominant group will seek to direct the approach to work on the construction project. Where for instance the dominant group takes health and safety seriously, the rest of the CPO will be more inclined to adopt a more health and safety conscious cultural orientation. It can thus be proposed that though they have limited time to exert influence on projects, the *dominant group* can influence cultural orientation in the CPO.

4.2.8 Goals and objectives

Differences in goals can be decisive in determining what the culture of an organisation would be. Goals such as quality of product, good place of work, centre of employment, service to community, and growth influence different cultural orientations in organisations (Handy, 1985; Mullins, 2005). A charity with community service goals will not have the same culture as an airline with profit goals. In relation to construction projects, CPOs pursue a variety of project-related goals such as achieving adequate quality, minimising cost, health and safety, and innovation. The prioritisation of these *goals* and *objectives* influences the organisational culture of the CPO.

4.2.9 Macro cultures

It has been suggested that different macro cultures also have an influence on the development of organisational culture (Handy, 1985; Hampden-Turner, 1994; Abu Bakar, 1998; Hofstede and Fink, 2007) and this is because the organisation is a microcosm of society and bears similarities in some respects to society. Within a construction project context, there are a myriad of organisations involved. Potentially these organisations may have different nationalities and therefore different national cultures. By limiting the scope of this research to construction projects in the UK undertaken by UK registered construction organisations, it is expected that the UK national culture will be the dominant macro-culture influencing individual behaviour. Using Hofstede's (2001) framework, the typical individual in a CPO will be expected to have a low power distance, individualistic, masculine orientation and weak uncertainty avoidance. Admittedly, there may be construction organisations with foreign ownership working on construction projects in the UK. However such organisations are a minority and as found in Dickson *et al.* (2000), such organisations exhibit little difference in organisational culture from local organisations. Moreover there is even evidence to suggest a growing homogeneity of business practices and managerial values across national cultures (Neuijen, 2002).

4.2.10 Location

Geographical location can have an influence on the types of clients served and the staff employed by the organisation, as well as opportunities for development. The physical characteristics of the location such as a busy city centre or a rural area are important considerations. These can all have a significant influence on culture (Mullins, 2005). Construction in the UK takes place all over the country, in various settings. Of some significance are the regional variations in construction output which are well documented (cf. Harvey and Ashworth, 1997; DTI, 2005). Such variations could potentially influence approaches to work, making *location* another relevant factor.

4.2.11 Summary

For the purposes of this research, it is possible to classify these determinants of culture in two ways; those that are *dependent* on the project and vary from CPO to CPO, and those that are *independent* of the project and are a characteristic of the construction industry and the environment as a whole, exerting pressure the same way irrespective of the CPO under consideration. These are listed in Table 4.1.

In developing a framework that gives an understanding of how the culture of CPOs develop, this distinction is very useful as it makes it possible to distinguish between those contextual factors that are the same irrespective of the project under consideration, and which push all CPOs towards certain specific cultural orientations, and those factors which vary from project to project and push CPOs in different cultural directions. These elements are captured in the simple framework shown in Figure 4.2.

Table 4.1 Project-dependent and project-independent determinants of culture

Project-dependent factors	Project-independent factors
Recruitment strategies & Composition of CPO	Macro-culture
Training initiatives	Industry characteristics
Project characteristics	Technology & primary function
Project Manager or dominant group	
Significant events	
Procurement approach	
Goals and objectives	
Location	

Research into CPO culture requires the collection of data on these various antecedents of organisational culture. Generally, the contextual data associated with the project-independent factors are well documented and can be derived from the literature. Therefore, the contextual data that a survey needs to focus on principally are the project-dependent factors, which will be the most useful in explaining the cultural differences that exist between CPOs.

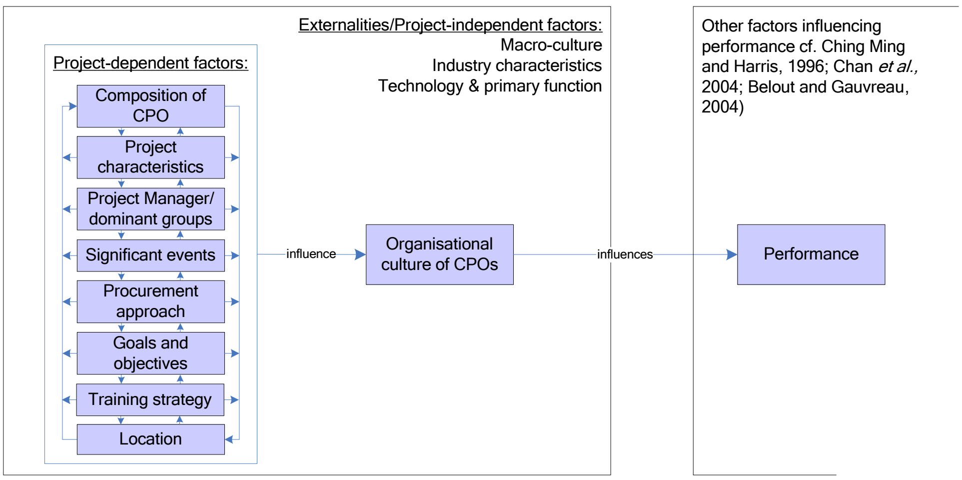

Figure 4.2 A framework for conceptualising the development of the organisational culture of a CPO

It is significant to note that the factors identified as determinants of organisational culture are inter-related in fundamental ways (Brown, 1998). Leaders (project managers or dominant groups) for instance are influenced by the macro-cultures, and they in turn set the goals and objectives of the CPO.

Another useful framework which also sought to identify culture's antecedents from a construction project perspective is that in Kumaraswamy *et al.* (2002). Also theoretical in content, this framework identified organisational, operational, professional and individualistic sub-cultures as the principal elements that come together to evolve the culture within the CPO through a process of 'negotiation'. As can be seen, the factors identified in this chapter are consistent with the Kumaraswamy *et al.* (*ibid*) framework demonstrating the validity of the arguments presented.

4.3 'BEHAVIOURS'

In terms of the manner in which organisational culture influences construction project performance, it has been suggested by several researchers that it influences attributes such as the propensity for litigation, the degree of participation and openness, approaches to decision-making, the quality of communications and working relationships, recruitment and human resource policies, management philosophies and practices adopted on construction projects, strategy, and approaches to construction (cf. Fenn *et al.*, 1997; Cooper, 2000; Riley and Clare-Brown, 2001; Low and Shi, 2001; Phua and Rowlinson, 2003; Skitmore *et al.*, 2004). This list of attributes or 'behaviours' is by no means exhaustive and it is necessary to broaden and categorise these factors to provide a comprehensive framework for investigating the influence of organisational culture on construction project performance.

These attributes of organisational culture have been severally referred to as indices of culture (Taylor and Bowers, 1972), aspects of culture (Thompson, 1993), traits of culture (Lui, 1999), indicators of culture (Handy, 1995; Hagberg and Heifetz, 2000), as well as elements of culture (Rameezdeen and Gunarathna, 2003). More commonly, as seen in the preceding chapter, these attributes are referred to as dimensions of culture (Schein, 1985; Trompenaars and Hampden-Turner, 1999; Hofstede, 2001).

Table 3.2 in the preceding chapter shows various empirically derived and theory-based dimensions compiled from the literature and include dimensions related to national culture as well as those related specifically to organisations. The former are also important as organisations are generally a microcosm of society as a whole. These dimensions are categorised under the headline dimensions of people, processes and systems, information management, control, technology, business focus, learning and innovation, and environment. It can be argued in line with Hofstede (2001) that these dimensions have been developed and applied in contexts and for specific reasons which may not necessarily apply within a construction project context. Further, they do not all focus on organisational practices in line with the findings and arguments of Hofstede *et al*. (1990), Smith (2000) and van den Berg and Wilderom (2004). This suggests a need to identify dimensions which are more relevant for this research.

To identify construction project-specific dimensions, it is first of all necessary to examine the sources of dimensions. As dimensions of culture are rooted in the fundamental problems that groups of people have to deal with or find solutions to (Schein, 1985; Hofstede, 2001), it can be argued that a useful source of information when looking for dimensions of CPO culture is to examine the fundamental problems of CPOs. The problems of CPOs are numerous and well documented, and nowhere better articulated than in the major construction industry reports that have been published since the Simon

(1944) report. These reports have examined the problems of the construction industry, and have in the main recounted the same industry failures time and time again, and none more so than the landmark Egan (1998) report which subsequent reports have also echoed.

In identifying the drivers for change for improving the performance of the construction industry, this report (Egan, 1998) provides pointers to the main fundamental problems ailing the industry. The report notes that for performance improvement, changes are required within the areas of:

- Leadership;
- Client focus;
- Process and team fragmentation;
- Quality delivery; and
- Commitment to people.

These problem areas are examined below, and the dimensions from the organisational culture literature which are associated with these problems are highlighted. It is important to emphasise the inter-relatedness of the problems and the dimensions they give rise to, and the solutions that are adopted in respect of these dimensions. Table 4.2 catalogues these dimensions of culture and their corresponding definitions.

4.3.1 Leadership

Egan (1998) expressed a lack of widespread evidence of the commitment of leadership to raise quality and efficiency required to improve performance. This point was also reiterated by Kashiwagi *et al*. (2004) who identified "a lack of leadership" in the construction industry and associated the project delivery process with a management rather than a leadership culture, arguing further that the use of a leadership oriented process minimised inefficiencies, thereby leading to performance improvement. This is an argument in favour of a more committed leadership orientation, a view shared by Chan and Chan (2005) who also point to transformational leadership as being a prerequisite for engendering improved performance. According to Liu *et al.* (2003) good leadership has motivational function.

A number of dimensions of culture may arise out of this need for more committed leadership. As captured in Table 4.2, these could include support for employees, people management, loose/tight or overt/suppressed control, decision-making practices, decisiveness, direction and goal clarification, process or results orientation, employee or task orientation, influence of lower levels, dealing with uncertainty and risk, and communication.

4.3.2 Client focus

According to Egan (1998) the customer drives everything in the best companies. Not so in the construction industry. The tendency rather has been to focus on the next job and the next employer. This is because of the nature of construction business which requires that constructors always focus on trying to secure new orders and maintaining a full order book to assure on-going work. In a study conducted by Dainty *et al.* (2005) to assess the competencies of project managers, it was found for instance that *customer service orientation* (a desire to meet customer needs) was of primary importance. Although the context in this case is slightly different, the import is the same as Egan (1998); that client focus is important for performance improvement.

Dimensions from the literature that can be associated with this particular problem include research into end-user wants/needs, education of clients, auditing client satisfaction, deal or relationship focus, client or market focus, reaction of customers (Table 4.2).

Table 4.2 Dimensions associated with the Egan agenda for change

Industry problems (Egan, 1998)	Related Dimensions	Definition
Leadership	Support for employees (Quinn, 1988; Low & Shi, 2001)	Caring and empathetic orientation of leaders. Encompasses listening, supporting legitimate requests, conveying appreciation, helpfulness and approachability (Quinn, 1988); reinforcement of the orders of site engineers by project managers (Low & Shi, 2001).
	Loose/tight or overt/suppressed control (Eldridge & Crombie, 1974; Hofstede, 1997)	The extent of formal internal structuring that regulates such aspects as dressing, language, punctuality and other acceptable behaviour (Hofstede, 1997)
	Decision-making practices (Taylor & Bowers, 1972; Thompson, 1993; Serpell & Rodriguez, 2002)	The extent of consultation involved in making important decisions (Low & Shi, 2001)
	Decisiveness, direction & goal clarification (Deal & Kennedy, 1982; Quinn, 1988)	The extent of planning and goal-setting. The extent to which problems are defined, objectives established, roles and tasks defined, and instructions are given by leaders (Quinn, 1988)
	Process or results orientation (Hofstede, 1997)	The extent of concern within the organisation for means as opposed to the concern for goals (Hofstede, 1997)
	Employee or job/task orientation (Hofstede, 1997; Trompenaars & Hampden-Turner, 1997)	The extent to which the organisation takes responsibility for employee welfare and takes account their personal problems, as opposed to an interest only in the work that employees do (Hofstede, 1997)
	Control or influence of lower levels (Taylor & Bowers, 1972; Coffey, 1996)	The amount of say or influence various levels in the organisation have on what goes on in the work group (Taylor & Bowers, 1972). The level of empowerment (Kashiwagi *et al.*, 2004)
	Dealing with uncertainty (and risk) (Handy, 1993; 1995; Hofstede, 1997; 2001; Deal & Kennedy, 1982; Erez & Gati, 2004)	Extent to which uncertainty (or ambiguity) is accepted or avoided (Hofstede, 2001)
	Communication (Thompson, 1993; Low & Shi, 2001; Serpell & Rodriguez, 2002; Skitmore *et al.*, 2004)	Willingness to talk to subordinates to let them know what is going on and to find out what is going on at their level (Low & Shi, 2001).
Client focus	Research into end-user wants/needs (Egan, 1998; Dainty *et al.*, 2005)	The amount of research undertaken into identifying end-user wants/needs
	Education of clients (Egan, 1998)	The level of importance associated with the education of clients on products and processes
	Auditing client satisfaction (Egan, 1998; Bryde and Robinson, 2005)	The extent to which organisation monitors the satisfaction of clients with their products and services
	Deal or relationship focus (Gesteland, 1999)	The emphasis on building long-lasting relationships with clients as opposed to just focusing on the current deal
	Normative or pragmatic orientation; Client/market focus (Thompson, 1993; Hofstede, 1997; Bryde and Robinson, 2005)	The extent to which the client (or market) drives the process (Hofstede, 1997). The priority given to clients (Thompson, 1993)
Process & team integration	Individualism or groupism (Schein, 1985; Handy, 1993; 1995; Trompenaars, 1994; Hofstede, 2001)	The extent to which the interest of individuals prevails over the interest of the group and vice versa i.e. power of the group (Hofstede, 2001)
	Relationship between management & staff (Thompson, 1993)	The accessibility and approachability of management to staff
	Cooperative behaviour (Phua & Rowlinson, 2003)	The extent to which members of one subgroup (in-group) cooperate with other employees who do not belong to that group (out-group) (Phua & Rowlinson, 2003)
	Attitudes towards work & others (Svensson & Wood, 2003)	Extent to which people enjoy working in organisation and working with other organisational members (Taylor and Bowers, 1972)
	Task organisation (Harrison, in Graves, 1986; Handy, 1993; 1995)	The extent to which tasks are arranged in such a way as to facilitate working together as

Industry problems (Egan, 1998)	Related Dimensions	Definition
		opposed to working in isolation
	Discussion, participation & openness (Schein, 1985; Quinn, 1988; Handy, 1993; 1995)	Obtaining input and participation from all employees (Quinn, 1988)
	Team focus (Erez & Gati, 2004)	The emphasis and effort put into achieving greater teamwork (Taylor and Bowers, 1972)
	Dealing with conflicts (Ngowi, 2000)	Ways of dealing with conflicts, including the control of aggression and expression of feelings (Hofstede, 1997)
	Communication flow (Taylor & Bowers, 1972)	The extent to which new members fit into the organisation and the degree of openness in information flow (Hofstede, 1997)
	Parochial or professional (Hofstede, 1997)	The extent to which employees identify with their organisation as against identifying with their professions (Hofstede, 1997)
	Finger-pointing/blame culture (Egan, 1998)	The extent to which people look for others to blame when things go wrong
Delivering quality	Insight, innovation & adaptation (Quinn, 1988)	The emphasis on creativity and doing things that have never been done before (Quinn, 1988). Acceptability of risks associated with failure and attitudes towards failure (Thompson, 1993)
	Learning (Low & Shi, 2001; Bryde and Robinson, 2005)	Providing organisation learning and development opportunities for project team members (Bryde and Robinson, 2005)
	Speed & degree of feedback (Egan, 1998)	Extent to which workers receive feedback on their performance and the performance of the organisation as a whole
	Attention to detail (Erez & Gati, 2004)	The amount of attention focused on getting things right
	Waste elimination (Egan, 1998)	The attitudes and effort put into eliminating waste and processes which do not add value (Egan, 1998)
	Delivery on time (Egan, 1998; Serpell & Rodriguez, 2002; Bryde and Robinson, 2005)	The attitudes and effort put into delivering construction products on time (Egan, 1998)
	Delivery within budget (Egan, 1998; Bryde and Robinson, 2005)	Attitudes towards costs and cost reduction (Thompson, 1993)
	Elimination of defects (Egan, 1998)	The attitudes and effort put into ensuring that mistakes are avoided (Egan, 1998)
Commitment to people	Concern, commitment & morale (Quinn, 1988; Thompson, 1993)	The amount of concern and interest the welfare and happiness of workers (Taylor and Bowers, 1972)
	Motivational conditions (Taylor & Bowers, 1972)	Extent to which people, policies and conditions encourage people to work harder (Taylor and Bowers, 1972)
	The primacy of human resources (Taylor & Bowers, 1972)	The level of importance placed by organisation on its people (Deal & Kennedy, 1982)
	Health and safety (Egan, 1998; Cooper, 2000)	The amount of effort put into ensuring that the health and safety of the workforce, clients and public is safeguarded (Cooper, 2000)
	Sustainability & Environmental awareness (DETR, 2000)	The amount of effort put into ensuring the judicious use of resources and that the construction process and product do not cause adverse impacts to the environment

4.3.3 Process and team fragmentation

It is noted that success does not derive from fragmentation, a fundamental problem/characteristic of the construction industry in which the project process is often executed as "a series of sequential and largely separate operations undertaken by individual designers, constructors and suppliers" (Egan, 1998). This problem is well documented (cf. Latham, 1994; Harvey and Ashworth, 1997; Fellows *et al.*, 2002; Cain, 2004), with Baiden *et al.* (2006) suggesting that consequently, many of the teams involved in project delivery work towards individually defined objectives that are often in conflict with one another.

Dimensions that typically arise from this problem include individualism or groupism, relationship between management and staff, cooperative behaviour, attitudes towards work and others, task organisation, discussion, participation and openness, team focus, finger-pointing or blame culture, dealing with conflicts, communication flow, communication, measurement, documentation and information management (cf. Baiden *et al.*, 2006).

4.3.4 Delivering quality

Delivering quality involves elements such as waste elimination, innovating for the benefit of the client, and delivering on time and to budget with zero defects (Egan, 1998). This ability to deliver quality is a fundamental challenge in construction, especially with clients selecting designers and constructors on the basis of lowest cost instead of overall value for money. The problems associated with project delivery in this regard are also well known (cf. Littlefield, 1998; Cain, 2004).

A number of dimensions arise out of the various elements associated with the challenge of delivering quality. These include insight, innovation and adaptation, learning, speed and degree of feedback, attention to detail, attitudes towards delivery on time, attitudes towards delivery to budget, attitudes towards elimination of defects.

4.3.5 Commitment to people

Fellows *et al.* (2002) have noted that it is commonplace to come across phrases like "people are our greatest assets" in construction. However Egan (1998) argues that there is still a problem in construction of recognising that its people are its greatest assets and hence a need to invest in their training and development, health and safety, decent site conditions, and fair wages. This problem also encompasses the lack of concern for the environment and the issue of sustainability, as these also relate to a concern for people within the society at large. It is not surprising to find for instance that construction has one of the worst records for health and safety and a poor record for recruitment and retention (Fellows *et al.*, 2002; Pearce, 2003). Problems of this sort associated with the people resource are constantly being reported especially in the trade magazines like Construction News (cf. Kernon, 2005; Prior, 2005; Booth, 2005; Anon, 2005; Prior, 2006; Rimmer, 2006).

Some of the dimensions that emerge from this fundamental problem include concern, commitment and morale, the primacy of human resources, motivational conditions, health and safety, sustainability, and environmental awareness (Table 4.2).

4.3.6 Relevance of dimensions identified

In a report prepared by the Construction Research and Innovation Strategy Panel (CRISP) Culture and People Task Group (2002) on a research strategy for culture and people in construction, a number of dimensions were proposed by construction industry experts. These dimensions were training, institutional structure, education, economic cycle, team skills, learning, leadership, image of construction, image promotion, incentives, motivation and attractiveness, safety and health, diversity, clients, legislation, craft versus process, service versus product, method of employment, corporate structures. A comparison of these dimensions and the dimensions shown in Table 4.2 clearly shows that the chosen dimensions are consistent with the aspects considered important by the CRISP Culture and People Task Group. This provides some support for the dimensions shown in Table 4.2 and demonstrates that they are relevant within a CPO context.

4.4 'CONSEQUENCES'

In Chapter 3, various consequences of organisational culture were discussed, although many of these suggestions were based only on anecdotal evidence. From a construction project perspective, the consequences of the culture within the CPO will ultimately be evaluated in terms of the project performance outcomes. Although as indicated in Chapter 2, organisational culture is not explicitly recognised as one of the key factors influencing construction project performance, it has also been argued that through its impact on various project-related factors, culture indirectly influences the performance outcomes of construction projects (refer Chapter 2). A simple framework that captures this relationship, as well as the inter-relatedness of the various factors influencing culture is shown in Figure 4.3.

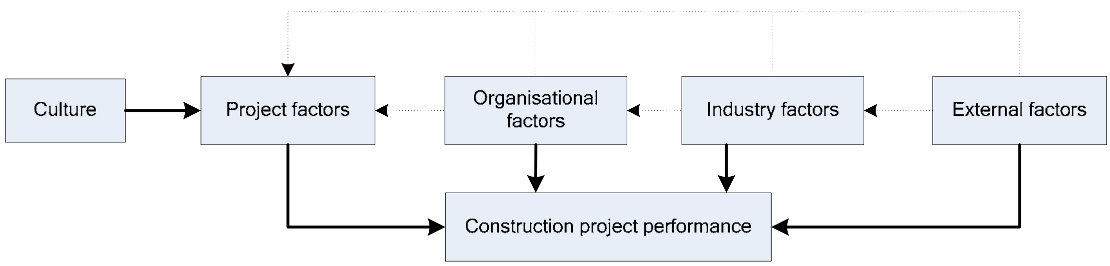

Figure 4.3 Factors influencing project performance outcomes: the role of culture [Adapted from Ankrah *et al*. (2005a)]

4.5 A CONCEPTUAL FRAMEWORK OF CULTURE AND PERFORMANCE

Fusing together the three strands of antecedents, behaviours and consequences, it is possible to develop a basic conceptual framework for this research that encapsulates the manner in which organisational culture within a CPO develops, the dimensions along which the culture manifests, and its subsequent influence on construction project performance. This conceptual framework is shown in Figure 4.4. It captures the antecedents in the form of project-dependent factors as well as the project-independent factors that combine to determine the culture within the CPO. These factors include *inter alia* composition of the CPO, project characteristics, project manager and dominant groups, significant events, procurement approach, location, macro-culture, industry characteristics, recruitment strategies, training initiatives, and technology and primary function. The culture that develops is manifested along a myriad of dimensions that can be classified in terms of the problems with which they are associated. In this framework, they are classified as commitment to client, teamwork, delivering improved quality, commitment to workforce and leadership. Through its impact on various project-related factors, culture then influences project performance.

This conceptual framework thus provides a useful basis for focusing attention on specific contextual and substantive variables in this research. Collection of data on these various variables will make it possible to assess the cultural orientations of project organisations along relevant dimensions, and to test for significant differences in cultural orientations for different construction projects. It will also be possible to assess the extent to which particular cultural orientations impact on project delivery and performance outcomes. Hypotheses are very helpful in this regard. From the conceptual framework and the preceding discussions, three fundamental hypotheses can be drawn to facilitate the examination of the data for relationships.

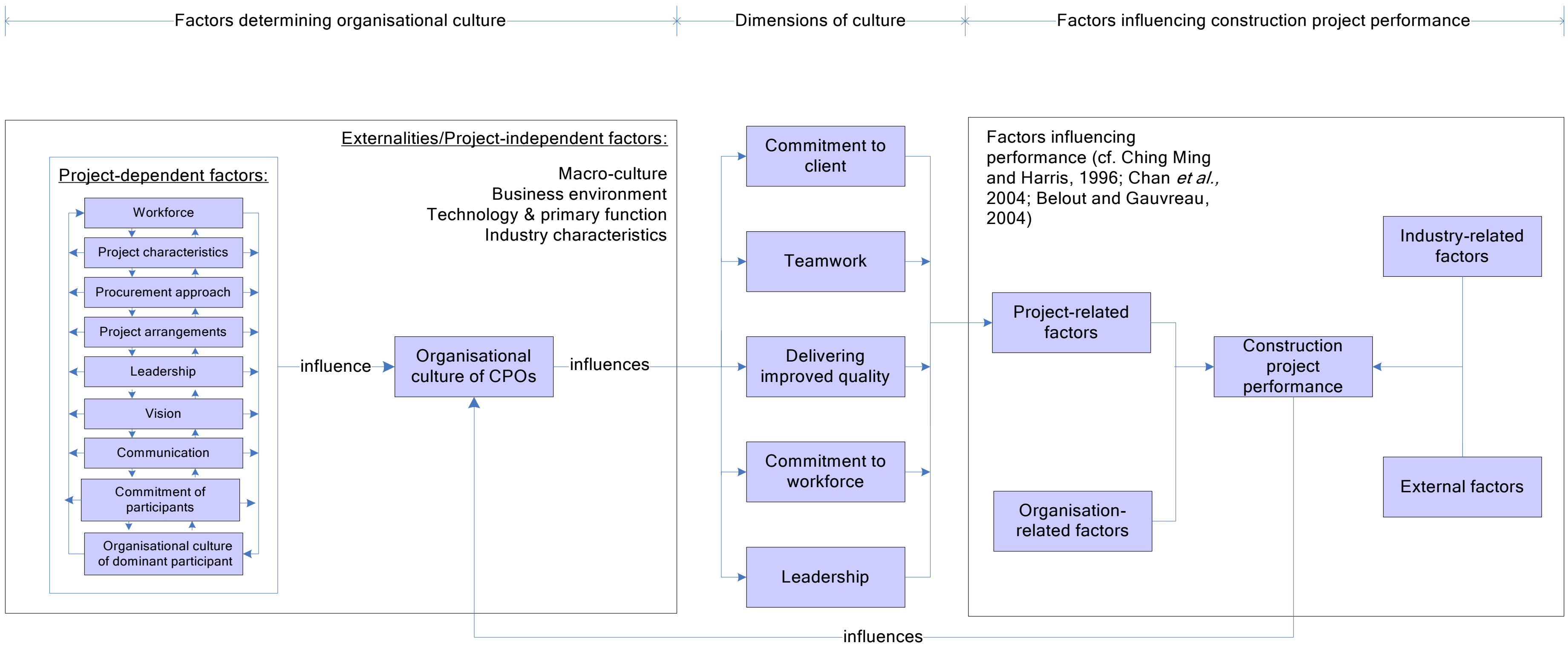

Figure 4.4 A conceptual model for investigating the influence of organisational culture on construction project performance

In the first instance, it has been shown from the literature that the culture within a CPO is contextually determined, with factors such as project composition and characteristics, dominant groups, occurrence or otherwise of significant events, procurement approach, prioritisation of goals and objectives, and project location potentially influencing the cultural orientation of the CPO as summarised in the conceptual framework (Figure 4.4). In terms of these factors, different projects are likely to have different configurations implying also that different cultural orientations are likely to exist on these projects. From this argument, it is reasonable to propose that:

H_1: There are significant differences in the organisational cultures of CPOs working on different construction projects in the UK.

As it is not clear from the empirical evidence provided in the literature what the nature of the relationship between project features and cultural orientations is, it is necessary to establish clearly by way of empirical research whether or not CPOs have different cultural orientations and to what extent these orientations are associated with key project features. Hypothesis H_1 must therefore be tested in the analysis of data.

Secondly, it has been demonstrated through the examination of the literature on performance of construction projects that several factors influence performance outcomes (refer Chapter 2). These factors have been captured in the conceptual framework under the categories project-related, organisation-related, industry-related and external factors. The implications of having these various factors impacting on performance outcomes are that different construction projects will achieve different levels of performance. It is therefore logical to propose that:

H_2: There are significant differences in the performance levels of different projects across the UK.

Here also, it is not clear from the evidence provided in the literature the extent by which performance levels actually vary across construction projects in the UK. It is therefore necessary to establish clearly from the data collected whether or not CPOs actually have significantly different levels of performance. Hypothesis H_2 must therefore be tested in the analysis of data.

Finally, it has been demonstrated by the literature review (refer Chapter 3) that there is sufficient theoretical basis and empirical evidence, albeit such evidence is mainly anecdotal, to argue that construction project performance outcomes are attributable in part to the culture within the CPO. It can thus be proposed that:

> H_3: There is a significant relationship between organisational culture and construction project performance.

Whilst such an association between culture and performance has been alluded to in several quarters within the culture-in-construction literature, as established through the literature review (refer Chapter 3), not much has been provided beyond anecdotal evidence to back this assertion. Given that the aim of this research as outlined in Chapter 1 was to look for empirical evidence of a relationship between culture and performance, H_3 provides an appropriate hypothesis that must be examined in the light of the data collected to achieve the aim of the research.

These three hypotheses presented above represent the main hypotheses of the research, and the subsequent data collection, analyses and discussion will focus on testing the validity of these hypotheses. For this to be done requires the development of empirical referents for measuring organisational culture and measuring the performance of construction projects. These are considered in the following subsections.

4.5.1 Measuring organisational culture – A social cognitive approach

Similar to the definition of culture adopted for this research, it has been argued by Cooper (2000) that the culture of an organisation in respect of any particular dimension comprises the solutions chosen by the organisation and its members in respect of that dimension, and the observable degree of effort with which all organisation members direct their attention and actions towards achieving the end goals for that particular dimension on a daily basis. It is expected that a variety of tendencies will arise for each particular dimension, corresponding to the preferences of individuals within the CPO and the CPO as a whole. The various dimensions that have been identified and collated in Table 4.2 refer to various attributes in respect of which certain attitudes, behaviours and conditions are expected within the CPO in order that the specific end goals will be achieved. It has been argued in Cooper (*ibid*) that there is an interactive or reciprocal relationship between these attitudes (psychological factors), behaviours (behavioural factors) and conditions (situational factors). In the words of Cooper (*ibid*) the solutions in respect of each dimension, and the effort put into pursuing them are reflected in the "…dynamic reciprocal relationships between members' perceptions and attitudes towards the operationalisation of organisational goals; members' day-to-day goal-directed behaviour; and the presence and quality of organisational systems and subsystems to support the goal-directed behaviour". This implies that assessing a particular dimension of culture requires an assessment of each of these three aspects.

This approach is best captured or explained by reference to Bandura's model of reciprocal determinism (Cooper, 2000) derived from Social Cognitive Theory (SCT) in which human functioning is viewed as the product of a dynamic interplay of psychological, behavioural and situational influences (Parajes, 2002). Social cognitive theory explains human functioning in terms of the triadic reciprocal causal relationship between the cognitive and other personal factors, behaviour, and environmental events which operate as interacting determinants that influence each other bi-directionally (Wood and Bandura, 1989; Pajares, 2002).

This implies that a complete picture of the cultural orientation can only be acquired when all these three aspects have been investigated as demonstrated in Cooper (2000). An adaptation of Bandura's reciprocal determinism model to reflect this approach can thus be depicted by the diagram in Figure 4.5.

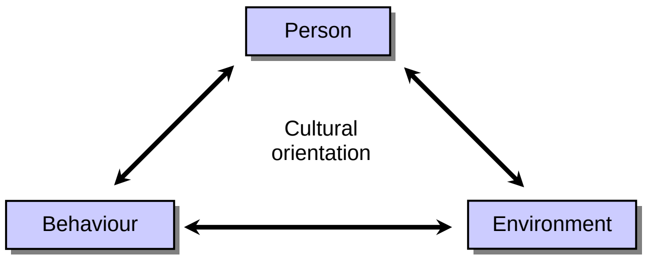

Figure 4.5 A reciprocal determinism model for the measurement of cultural orientation

The measurement of culture in respect of each dimension must therefore consider:

1. Perceptions and attitudes towards organisational goals in respect of the dimension;
2. Day-to-day goal-directed behaviour in respect of the dimension; and
3. The organisational systems, subsystems and processes that exist to support the goal-directed behaviour.

Indeed Cooper (2000) has demonstrated that this approach to the study of culture has general applicability, and has utility in the quantitative assessment of culture. Each of these aspects must thus reflect in the survey conducted in this research.

4.5.2 Measuring performance

As argued in Ankrah and Proverbs (2005), performance within a construction project context may be regarded as how well the CPO has done in pursuit of project objectives, and performance measurement as the evaluation of the output and final project outcomes based on the inputs employed in the construction process (Takim *et al.*, 2003). Quite clearly, it provides the means to identifying areas of unnecessary costs and inefficiency in the construction process (Cain, 2004) so that through benchmarking and the implementation of change, improvements in processes, activities and final project outcomes can be achieved.

Various performance measures and measurement frameworks exist for the purpose of measuring performance, notable among which are the 'iron triangle', 'star of David', and the Constructing Excellence KPIs (cf. Chan *et al.*, 2002; Ankrah and Proverbs, 2005). It was concluded in both Griffith *et al.* (1999) and Ankrah and Proverbs (2005) following a detailed review of literature on performance measurement, that a 'one-fits-all' approach to performance measurement is non-existent. It is therefore argued for this research that the choice of measures and frameworks must be based on the motivation or purpose of the measurement. In this research which seeks to examine the extent to which the organisational culture of CPOs influences project performance, it is argued that an appropriate approach will be to focus on those measures of performance which evaluate project outcomes or 'consequences' associated with the dimensions of the CPO's culture. This is consistent with theory of task performance (Locke, 1970 in Soetanto *et al.*, 1999) and the goals model (Belout, 1998; Liu *et al.*, 2006).

In identifying the appropriate measures to be adopted in this research, the existing frameworks provided useful insights. Quite clearly, the corner stone of performance measurement are the 'iron triangle' measures of cost, time and quality (Atkinson, 1999). These criteria are a common feature of virtually all frameworks examined in Ankrah and Proverbs (2005). Despite the inclusion of various other measures, and despite the fact that cost, time and quality are not always an accurate reflection of performance since some projects are justifiably over-budget or delayed (Tam and Harris, 1996), these three measures still represent the ultimate and most important measures of project performance (Belout, 1998; Chua *et al.*, 1999; Xiao and Proverbs, 2003). It is thus argued that as these measures represented the bottom line measures of performance in construction, they must be featured in performance measurement in this research as well.

Going by Takim *et al.*'s (2003) proposition of assessing performance by evaluating the inputs, outputs and final project outcomes, and taking organisational culture as an input, it can be argued that the other measures of project performance to be applied in this research must be based on the outcomes which are the direct and indirect consequences of organisational culture as an input. An appropriate analogy is the evaluation of the 'performance' of food on the basis of taste when the interest is in an input such as salt. An outcome such as appearance or aroma will be most inappropriate in this case. Figure 4.6 summarises this approach to be employed in choosing the other appropriate measures of performance in this research.

The task is therefore to identify objectives pursued by CPOs. Project organisations pursue several objectives many of which can be associated with the culture within the CPO. Researchers like McComb *et al.* (1999), Chua *et al.* (1999), Ford (2002), Chan *et al.* (2002), and Cain (2004) have identified some of the objectives pursued by project organisations as cost control, on schedule completion, technical goals (i.e. technical completion of project and functionality), high quality, minimal defects, reduced cost-in-use, employee satisfaction, productivity, profitability, absence of conflicts and claims, harmony between participants and safety *inter alia*. Table 4.3 shows the links between these objectives and the dimensions of culture.

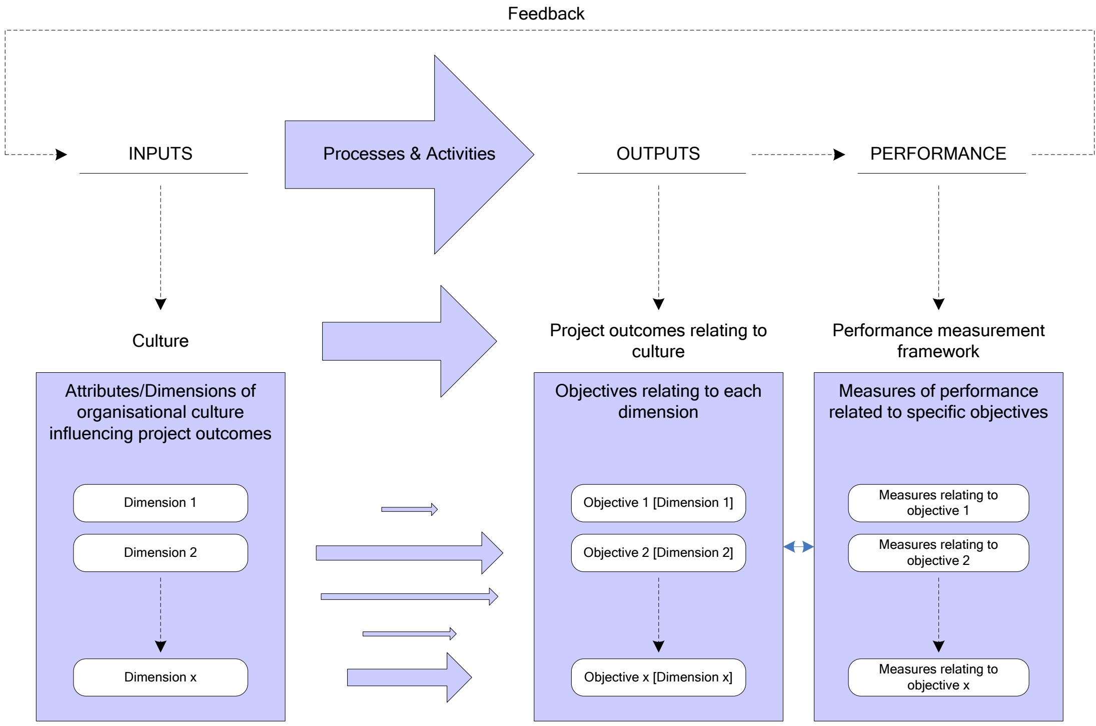

Figure 4.6 A proposed approach for choosing performance measures

Scouring through the dimensions of culture extracted from the literature and their related goals and objectives, it is possible to identify a number of associated project performance measures that are consistent with the approach shown in Figure 4.6 and also with the various performance measurement frameworks reviewed in Ankrah and Proverbs (2005). These measures are shown in Table 4.3 below.

Table 4.3 Dimensions derived from the Egan agenda for change and their associated performance measures

Industry problems	Related Dimensions	Goals & objectives	Potential performance measures
Leadership	Support for employees	Committed leadership	Employee satisfaction (Liu *et al.*, 2006)
	Loose/tight or overt/suppressed control	Empowerment of all participants	Harmonious relationships (Nicolini, 2002)
	Decision-making practices	Free & open communication	
	Decisiveness, direction & goal clarification	Clear goals	
	Process or results orientation		
	Employee or job/task orientation		
	Control or influence of lower levels		
	Dealing with uncertainty (and risk)		
	Communication		
Client focus	Research into end-user wants/needs	Satisfy clients in service	Repeat clients/work (Dozzi *et al.*, 1996)
	Education of clients	Exceeding client expectations	Client satisfaction (Belout, 1998)
	Auditing client satisfaction	Identification of value from client perspective	Disputes with client (Nicolini, 2002)
	Deal or relationship focus	More client involvement	End-user satisfaction (Belout, 1998)
	Normative or pragmatic orientation; Client/market focus		
Process & team integration	Individualism or groupism	Trust	No. of disputes (Nicolini, 2002)
	Relationship between management & staff	Cooperation	No. of claims (Nicolini, 2002)
	Cooperative behaviour	No-blame culture	Harmonious relationships (Soetanto *et al.*, 2002)
	Attitudes towards work & others	Participation	
	Task organisation	Good information sharing & management	
	Discussion, participation & openness	Production of all relevant documentation	
	Team focus	Integration	
	Dealing with conflicts		
	Communication flow		
	Parochial or professional		

Industry problems	Related Dimensions	Goals & objectives	Potential performance measures
	Finger-pointing/blame culture		
Delivering quality	Insight, innovation & adaptation	Right first time	Cost (Nicolini, 2002)
	Learning	No defects	Time (Nicolini, 2002; Liu *et al.*, 2006)
	Speed & degree of feedback	Reduced cost-in-use	Quality of product (Nicolini, 2002; Liu *et al.*, 2006)
	Attention to detail	Innovate new methods	Quality of service (Nicolini, 2002; Liu *et al.*, 2006)
	Waste elimination	Learning from projects	Reworking (Liu *et al.*, 2006)
	Delivery on time	Deliver on time	New methods/techniques developed (Belout, 1998)
	Delivery within budget	Deliver within budget	Amount of learning (Kululanga *et al.*, 2001; Anderson, 2003)
	Elimination of defects		
Commitment to people	Concern, commitment & morale	Fair wages	Labour turnover (Guest *et al.*, 2003)
	Motivational conditions	Decent site conditions	Absenteeism (Liu *et al.*, 2006)
	The primacy of human resources	Development of employees	Industrial action (Liu *et al.*, 2006)
	Health and safety	No accidents/injuries/deaths	No. of accidents (fatal/non-fatal) (Chinyio *et al.*, 1998)
	Sustainability & Environmental awareness	Sustainable products & protection of the environment	Employee satisfaction (Liu *et al.*, 2006)
		Respect for people (Egan, 1998)	Productivity (Liu *et al.*, 2006)
		Retention of people	Environment (Atkinson, 1999)
		Diversity	
			Overall performance

4.6 SUMMARY

On the basis of the literature review a conceptual model has been developed showing the contextual variables that are instrumental in determining the organisational culture of construction project organisations that develops, the relevant dimensions along which the culture of the CPO manifests, and how these dimensions of culture subsequently influence project performance outcomes. The model shows that the culture of a CPO is influenced by composition of the CPO, project characteristics, project manager and dominant groups, significant events, procurement approach, location, macro-culture, industry characteristics, recruitment strategies, training initiatives, and technology and primary function.

The culture that emerges manifests along a number of dimensions that can be generically classified as leadership, commitment to client, process and team integration, delivering improved quality, and commitment to people. The orientations along these dimensions will have consequences for project performance outcomes as measured *inter alia* by cost, time, quality, health and safety, absenteeism, productivity, disputes and harmony.

On the basis of the conceptual model, three fundamental hypotheses have been proposed for testing in the subsequent phases of this research. These hypotheses relate to a difference (or lack of it) in cultural orientation among CPOs, a difference (or lack of it) in performance levels of the different CPOs, and a relationship (or lack of it) between the cultural orientation and performance outcomes.

Testing of these hypotheses requires the measurement of organisational culture and project performance. It is argued, in line with Bandura's social cognitive theory, that the measurement of culture should address attitudes and perceptions, goal-directed behaviour, and situational conditions associated with the various dimensions of culture (Cooper, 2000). It is also argued, in line with Takim *et al*. (2003), that the measures of performance assessed should be measures associated with the goals and objectives associated with the dimensions of culture. These considerations must be incorporated in the research design. The following chapter discusses the research methodology that will make this possible. It outlines the research design and data collection strategies to be employed in obtaining the data required to measure culture and performance so that the hypotheses can be tested.

CHAPTER 5: RESEARCH METHODOLOGY

5.0 INTRODUCTION

This chapter outlines the research methodology adopted for undertaking this research study; in this case a quantitative methodology, which incorporates to a small degree some aspects of the qualitative approach. Arguments are presented justifying the choice of this approach and the specific research methods applied to collect data. Coupled with the application of social cognitive theory for the diagnosis of culture, the methodology represents a unique contribution to the study of culture from the construction project context.

5.1 INVESTIGATING THE RELATIONSHIP BETWEEN CULTURE AND PERFORMANCE – THE RESEARCH PARADIGM

Investigating the relationships highlighted in the conceptual model requires a consideration of the overall research paradigm within which the research is to be undertaken, and the research methods that are appropriate within this paradigm. In research there are two major paradigms; the qualitative paradigm (aka[3] phenomenological or interpretive) and the quantitative paradigm (aka positivist). It has been observed in Walker (1997) that part of the process of undertaking 're-search' which literally means "to search again" is to review problems from different perspectives. The choice of research methodology should enable this process to take place, and should allow the

[3] aka – also known as

systematic and objective gathering, processing and analysing of data (Walker, 1997) to provide the new perspectives required.

In order to achieve the aim of this research which requires a comparison of CPOs on a uniform basis so that empirical examination of the relationships between cultural orientations and performance outcomes can be undertaken, an overall positivist orientation was adopted. It was shown in the literature review (refer Chapter 3) that research into culture in a construction context have typically been either qualitative or quantitative. It was also shown that the research specifically addressing culture at the project level have in the main been qualitative. Therefore to provide new perspectives, which is the essence of undertaking research, the quantitative approach was considered appropriate. In Chapter 3, the weaknesses of both qualitative and quantitative approaches of culture research were highlighted and it was argued in line with Hofstede *et al.* (1990) and van den Berg and Wilderom (2004) that the most appropriate approach for this kind of research would be a conciliatory approach combining both qualitative and quantitative approaches. For this reason it was considered justifiable to incorporate within this overall positivist paradigm, an element of the qualitative approach to satisfy this requirement for a conciliatory approach. This approach is consistent with Denison and Mishra's (1995) methodology for investigating the relationship between organisational culture and effectiveness, and is also consistent with the arguments of Raftery *et al.* (1997), Kumaraswamy *et al.* (1997) and Liu (2002) in favour of some degree of methodological liberalism in synthesising paradigms where appropriate in construction management research.

Creswell (2003) provides an example of a scenario in which this approach can be situated *viz*; where for instance the researcher wants to both generalise the findings to a population and develop a detailed view of the meaning of a phenomenon or concept for individuals, the researcher may first explore generally in a qualitative manner to learn about what variables to study, and then study those variables with a large sample of individuals quantitatively. This scenario mirrors this research and shows that the approach being adopted for this research is appropriate.

In line with Creswell's (2003) sequential exploratory strategy, the approach proposed for this research comprises in-depth interviews to begin with (qualitative), to capture as much as possible, the language and meanings of the industry, and to capture a sense of what organisational culture is perceived to be from a construction practitioner's perspective. Information obtained from this process is then to be fed into the development of a questionnaire survey (quantitative) to incorporate several conceptually related questions covering each of the various dimensions identified through the qualitative investigation. An overall outline of this approach is shown in Figure 5.1. As indicated already, an overall positivist paradigm is being adopted in this research and therefore the greater priority in this research is placed on the quantitative aspects. This is because as argued previously (refer Chapter 3) this approach best facilitates the comparison of organisations on the same basis and allows the research objectives of empirically examining the relationships between cultural orientations and performance outcomes to be pursued.

Key to this whole approach is the focus on the construction project context, and on practices or preferred solutions for dealing with some of the fundamental problems experienced by CPOs in line with the definition of culture assumed for this research.

As far as research into organisational culture in the construction industry is concerned, applying this approach represents a significant departure from the approaches applied in construction culture research like Maloney and Federle (1990), Root (2002), Serpell and Rodriguez (2002), Rameezdeen and Gunarathna (2003), and Ankrah and Langford (2005).

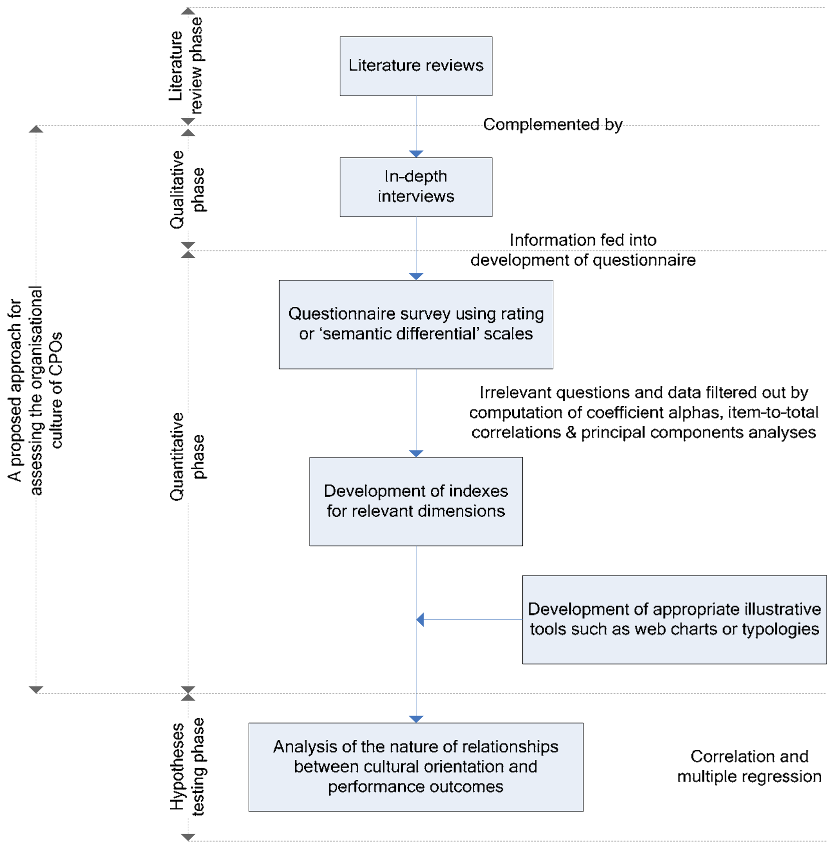

Figure 5.1 A conciliatory methodology for assessing the organisational culture of CPOs

5.2 THE QUALITATIVE PHASE

The qualitative paradigm, comprising such methodologies as action research, case studies, ethnographies, and grounded theory, has been strongly advocated for construction management research by Seymour and Rooke (1995) and Rooke *et al.* (1997), and in particular for research into culture in construction. The utility of this paradigm as explained by Seymour and Rooke (1995) lies in the deeper understanding of the values and beliefs of others that can be derived by focusing on the points of view of individual practitioners, whilst recognising that the researcher has values and beliefs of their own that cannot be entirely eliminated. Qualitative methodologies are explanatory in nature with the principal aim of trying to unearth answers to 'how?' and 'why?' questions (Walker, 1997), or trying to develop themes from the data (Creswell, 2003). Recalling the discussions in Chapter 3, it can be seen that this approach is ideally suited to an investigation of culture conceptualised as an ideational phenomenon (anthropological perspective) or as a root metaphor (organisational perspective).

As can be observed from the research objectives, the hypotheses and the thrust of all the preceding chapters, the main focus of this research was not to address 'how?' and 'why?' questions. However, it was considered logical to incorporate elements of this methodology within this research, especially as this would yield some insight into construction culture "from the inside and through the definition" of practitioners (Hofstede, 2001; Rooke and Seymour, 2002), and help identify aspects or dimensions of culture that were considered important from construction practitioners' point of view without imposing biases from the literature. This phase of the research was thus exploratory in nature.

Following the precedent set by Hofstede *et al.* (1990), interviews were adopted as an appropriate method for collecting the qualitative data required for this phase to enable the exploration of the culture phenomenon. It is on record that interviews are the most widely used qualitative method in organisational research (King, 1994).

Fundamentally, the interviews were to capture a sense of what organisational culture is from a practitioner point of view. The interviews were also to identify the fundamental problems CPOs have to deal with and potential aspects of organisational practices which mirror the culture of CPOs and may be operationalised as dimensions. By conducting these interviews, it was possible to consider the relevance of the dimensions identified from the literature as captured in Table 4.2. As argued by Delobbe *et al.* (2002), *a priori* dimensions such as those in Table 4.2 are only useful to the extent that they are sufficiently relevant and generic. The interviews were therefore an opportunity to test the relevance and comprehensiveness of these dimensions and the conceptual framework as a whole (cf. Nicolini, 2002).

5.2.1 Interviews

The interviews were an opportunity to ignore *a priori* ideas and to draw on the knowledge of practitioners without imposing biases or knowledge obtained directly from literature or experience (cf. Nicolini, 2002). Like Hofstede *et al.* (1990), the intention was to paint a qualitative, empathetic description of the culture on construction projects.

A series of in-depth semi-structured interviews were carried out with experienced practitioners working within the industry. The main thrust of the interviews was to draw out those issues that were considered important on construction projects and the main challenges faced by project organisations. It was also to draw out *'who'* and *'what'* had a significant impact on the culture of the project organisation. These interviews permitted the development of a certain level of empathy with the circumstances of the organisations being investigated – a requirement set out in Hofstede (2001) and Serpell and Rodriguez (2002). The interview schedule used to guide the interviews is shown in Appendix C. It is important to emphasise that this schedule only served as a guide, and the interviewer was free to probe and ask questions in any order as appropriate. In line with Trompenaars and Hampden-Turner (1999), the investigations were always started with the question "what does the concept of culture mean to you?"

Nine interviews were conducted in all with highly experienced construction industry practitioners who represented major construction organisations operating out of the West Midlands (UK). Seven of these participants were approached directly to participate in this research and a further two indicated their willingness to be interviewed when they responded to a random questionnaire survey (Appendix B) of West Midlands based construction organisations. Participants had an average of 22 years working experience. Their positions included Managing Director, Operations Director, Regional Manager and Health & Safety Manager.

Average duration of these interviews was *circa* 51 minutes. All interviews were recorded and transcribed later to support the notes taken. The method of analysis adopted was the template approach involving the examination of the interview transcripts for common themes and sub-themes using an analysis guide. The analysis guide, also referred to as a 'codebook' in King (1994) was derived largely from the literature and consisted of themes related to what culture means, how culture develops, and how culture manifests. This guide book was modified as necessary with the on-going analysis of the interview transcripts and provided a systematic basis for examining the data. To facilitate the analysis of data, the NVivo NUDIST software was employed for coding, organising, linking, and exploring the transcripts and notes. The software enabled the coding of responses from interviewees and organising these into appropriate themes and sub-themes in line with the analysis guide.

This qualitative phase was intended to help in refining the definition of culture, and refining the framework for measuring the organisational culture of CPOs in the main questionnaire survey. Some of the findings of this qualitative phase have been reported in Ankrah *et al.* (2007d). Key findings are summarised below.

5.2.1.1 What is culture?

In response to the question "what does the concept of culture mean to you?", a range of views were expressed by the interviewees. According to interviewees;

"Organisational culture...is about the passion and the pace of the business, and...the smell of the place. Does it smell right? Does it feel right?...does it have the energy? Is there a positive energy there, as opposed to a negative energy? Do people have that passion for their role?...do they really want to succeed? And when they are talking to you are they convincing about the process that they are involved in, about the work that they are involved in? And can it be delivered at pace, is there an ability to change?"

"…it's all about people and their attitudes. That's the way I can describe it."

Although not quite as academically framed as the definitions of culture reviewed in Chapter 3, it can be seen from the above quotations that the interviewees, who are construction project participants, have the same notions of culture as implied in the theories. Consistent with the theoretical arguments made about emphasising practices in the assessment of organisational culture, interviewees related the culture not only with assumptions or meanings, but more with the attitudes of workers and with their behaviours saying;

"…within the culture, there needs to be a set of recognisable behaviours. So you have to be able to say yes, I understand that person works for XYZ[4]…because they demonstrate these behaviours"

"…a kind of an all encompassing thing there that says there is a set of behaviours…and you should be able to see those in people that you interface with."

In terms of the descriptors used by interviewees to illustrate some of the cultures they had experienced, some of the insightful ones are captured in Figure 5.2 below.

[4] XYZ has been inserted in place of the real name of the organisation.

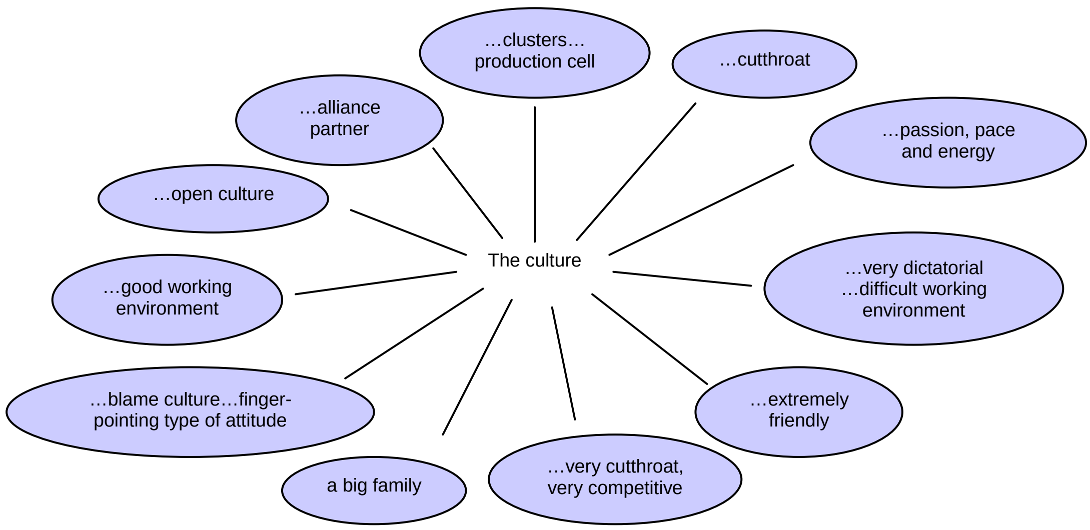

Figure 5.2 Descriptors of culture provided by inteviewees

These descriptors shown in Figure 5.2 demonstrate the variety of cultural orientations that project participants experience, some of which were considered by interviewees as positive and desirable e.g. an open culture, extremely friendly and a big family, and others that were considered as negative and undesirable e.g. blame culture, very cutthroat and competitive, and very dictatorial. This provides further justification for investigating the hypothesis stated in the preceding chapter that there are no differences in the organisational cultures of CPOs.

5.2.1.2 Antecedents

Interviewees identified several factors that potentially influence the culture that develops within the CPO similar to the model presented in Figure 4.4. These factors are illustrated in Figure 5.3. It was clear from the responses of the interviewees that key participants in the construction process play a role in the culture that develops. These participants are shown in Figure 5.3 as the Main Contractor, Client, Subcontractors (and Suppliers), the professional team (or Architect) and particular key individuals.

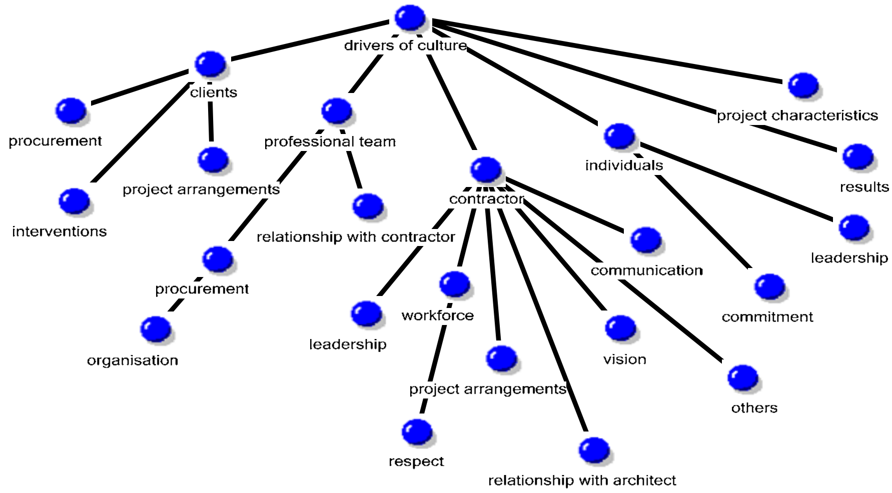

Figure 5.3 Factors influencing the culture of the CPO (NVivo NUDIST output)

This is in agreement with Kotter and Heskett (1992), Meudall and Gadd (1994) and Mullins (2005) all of which identified the composition of an organisation (in this case the CPO) as a key determinant of the culture that develops. In most cases, the contractor is the principal actor in the development of culture. It is the contractor who drives the culture and the entire project through, and leads the rest of the CPO. As appropriately stated in reference to the main contractor:

> *"the culture comes from the top!"*

From Figure 5.3 it can be seen clearly that the culture of a CPO is determined by a number of factors that can be classified, similar to the conceptual model as *project-dependent* factors. These factors are the workforce, project characteristics, procurement approach, project arrangements, leadership, vision, communication, commitment of key individuals, as well as the organisational culture of the dominant participant, and these may vary from project to project. Interviewees also made references to differences due to nationality and industry which for this research can be considered as recognition of the impact of *project-independent* factors. Such project-independent factors are the same irrespective of the project under consideration.

5.2.1.3 Behaviours

The responses of the interviewees showed that these manifestations of culture can be viewed generally in terms of relationships between participants, attitudes of people and their actual behaviours. These views are consistent with the various theories of culture discussed in Chapter 3 (cf. Allaire and Firsirotu, 1984; Schein, 1985; Denison and Mishra, 1995; and Hofstede, 2001). The various dimensions raised by the interviewees are shown in the model generated by the NVivo NUDIST software (Figure 5.4).

Many of these dimensions of culture are consistent with the dimensions of culture already identified in the literature (cf. Taylor and Bowers, 1972; Quinn, 1988; Thompson, 1993; Handy 1993; 1995; Erez and Gati, 2004; and Mullins, 2005) and captured in Tables 3.2 and 4.2 (refer Chapters 3 and 4). Examples are communication, innovation, decision-making, participation, commitment to people and client/customer focus. This consistency demonstrates the validity of the issues raised by the interviewees. Significantly, there are other dimensions raised by interviewees which were not represented in the dimensions identified in the general management and organisational literature. These are issues which reflect the uniqueness of the problems faced by CPOs and the issues they have to deal with. Examples of these are planning, site tidiness, health and safety, partnering and subcontracting.

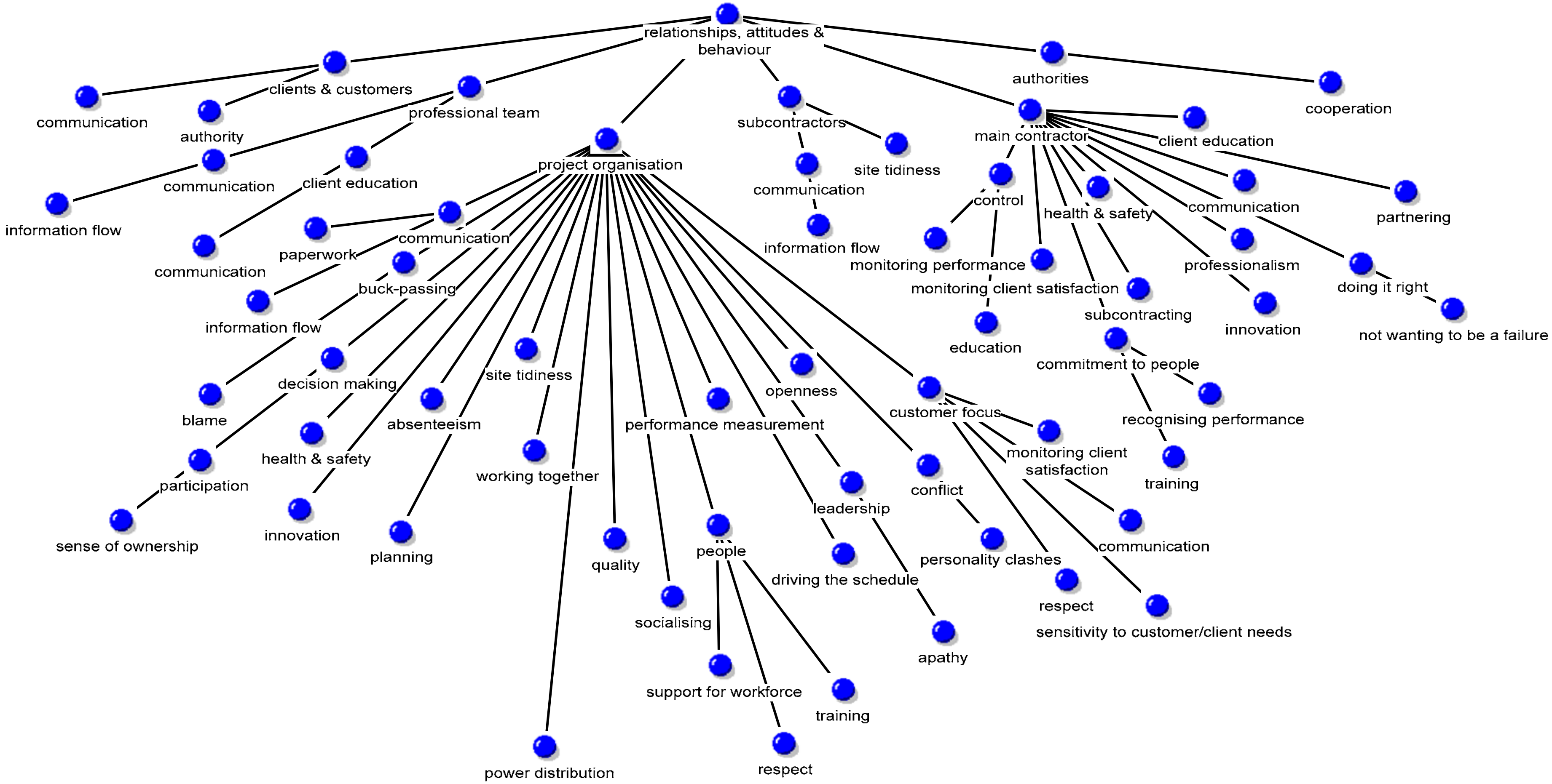

Figure 5.4 Dimensions of culture which are relevant from a construction perspective as identified by interviewees (NVivo NUDIST output)

It is possible to classify all the dimensions identified by the interviewees in generic groupings in relation to the ways in which they affect the project as a whole, similar to the classification in Table 4.2 (refer Chapter 4). There are dimensions relating to the client, to teamwork, delivering improved quality, welfare of workforce and leadership (see Table 5.1).

Table 5.1 Dimensions of culture identified by interviewees

Generic classification	Dimension
Commitment to client	Communication, Client education, Respect for client, Sensitivity to client/customer's needs, Monitoring client satisfaction
Teamwork	Communication , Buck-passing (blame culture), Participation, Collaborative working, Openness, Conflict, Subcontracting, Partnering
Delivering improved quality	Learning & innovation, Quality, Performance measurement & continuous improvement, Driving the schedule, Doing it right
Welfare of workforce	Health & safety, Site tidiness, Respect & Support for workforce, Training, Retention, Commitment to people, Recognising performance
Power distribution/ Leadership	Leadership, Control, Professionalism, Participation (decision-making), Communication, Exercising authority

These dimensions will be operationalised as the core set of dimensions to form the basis for the questionnaire survey that will subsequently be undertaken.

5.2.1.4 Consequences

Several references were made by interviewees to positive outcomes as a result of their orientations in respect of the various dimensions outlined above. There were references to "customer delight," "no accidents," delivery "within budget" and "on schedule," "client/customer satisfaction," "happy workforce," and several "repeat clients." Indeed within the construction industry, performance of a project is often evaluated in these very terms (cf. Maloney, 2002; Soetanto *et al.*, 2002; and DTI, 2004). This provides further evidence that there is a basis for a hypothetical link between culture and project performance.

5.2.2 Implications for conceptual model

The findings from the interviews suggest that generally the relationships highlighted by the conceptual model are well founded, consistent with what obtains in the construction industry as *per* the views of practitioners, and can thus be used as the basis of the questionnaire survey. The conceptual model however requires a few minor modifications in respect of the determinants and dimensions of culture to reflect the perspectives provided by the interviewees. Having established this, the research was able to proceed to the quantitative phase of the investigation.

5.3 THE QUANTITATIVE PHASE

A quantitative approach to this research was considered necessary because as noted in Walker (1997), empirical research provides strong evidence for explaining phenomenon, enabling researchers to address the questions '*how much*' or '*how many*?'. More appropriately in the context of this investigation this kind of research enables the researcher to establish "which variables are significant, and to what extent, in a scientific way" (Walker, 1997), thus allowing the objective of explanatory assertions about the sample, and by inference the population, to be achieved (Babbie, 1990; Czaja and Blair, 1996).

In conducting quantitative research, three main approaches are typically employed. These approaches are identified by Fellows and Liu (1997) as 'desk research', experimentation and surveys.

5.3.1 'Desk research'

Desk research involves using data collected by others, perhaps analysing it in alternative ways to yield fresh insight. This approach according to Fellows and Liu (1997), though cheap, time saving and suitable for studies in such areas as macro-economics where data can not be obtained by any other viable alternatives, is also often problematic. The problems stem from the fact that the data, collected for other purposes, may not be well tailored for the particular research being undertaken. Besides, sampling may also not be appropriate to the requirements of the research, and the data may have inherent limitations due to the manner in which it was collected (*ibid*). For this research, the bespoke nature of the framework adopted precluded the application of this strategy.

5.3.2 Experimentation

In experimentation, results are sought by effecting incremental changes in the independent variable and measuring the effect, if any, on the dependent variable (Fellows and Liu, 1997; Creswell, 2003). It is acknowledged in Fellows and Liu (*ibid*) that this strategy poses significant problems for research in the social sciences which are far in excess of those encountered in a science research laboratory. The most significant of these problems relates to the amount of control over the variables. It is argued (*ibid*) that society is dynamic and the number of variables operating is vast, making it difficult to hold constant all the extraneous factors influencing the outcomes of the experiment. In this research, where there is very limited control over the research environment (the construction project), these problems imply that the experimentation research strategy is also inappropriate.

5.3.3 Survey research

According to Czaja and Blair (1996), survey research is one of the foremost means of social investigation. It builds on previous work which has already developed principles, laws and theories that help to decide the data requirements of the particular research project (Fellows and Liu, 1997). Survey research include cross-sectional and longitudinal studies using questionnaires or structured interviews for data collection, with the aim of generalizing from a sample to a population (Babbie, 1990; Creswell, 2003).

Although it also has limitations such as low response rates (for questionnaire surveys) and the risk of bias, this strategy offers the opportunity to explore a broad range of issues such as those envisaged in this research.

In this research therefore, the survey research design was adopted in the quantitative phase to provide, as indicated by Creswell (2003), a quantitative description of trends, attitudes, or opinions of the population by studying a sample of that population. Specifically, a cross-sectional questionnaire survey of construction project participants was adopted with the questionnaire designed to elicit information about the construction project in respect of project features, performance outcomes and cultural orientations. Table 5.2 shows the dimensions of culture and performance measures derived from the literature and interviews which were addressed by the questionnaire.

5.3.3.1 Unit of analysis

The aim of this study is to establish the existence or otherwise of a relationship between the cultural orientation of the CPO and the project performance outcomes. From this it can be seen that the appropriate unit of analysis for the research is the construction project, with the survey enquiring into the culture of the CPO or temporary project multi-organisation delivering the project and the performance outcomes of the projects on which they were engaged. Because of the multi-organisational nature of construction projects, within this unit of analysis, there exist embedded units with their own subcultures. These subcultures as recognised in Kumaraswamy *et al.*'s (2002) framework, relate not just to organisational differences but also to operational, professional and individualistic differences, making it similar to regular organisations where departmental and divisional subcultures also exist within the overall organisational culture. To ensure therefore that the survey captured the culture of the CPO rather than the embedded units, the questionnaire was developed with specific emphasis on the project.

Table 5.2 Dimensions of culture and their associated performance measures derived from literature and the interviews

Industry problems	Related Dimensions	Goals & objectives	Potential performance measures
Leadership	Support for employees	Committed leadership	Employee satisfaction
	Relationship between management & staff	Empowerment of all participants	Harmonious relationships
	Loose/tight or overt/suppressed control	Free & open communication	
	Participation (decision-making)	Clear goals	
	Decisiveness, direction & goal clarification		
	Control or influence of lower levels		
	Communication		
Client focus	Communication	Satisfy clients in service	Repeat clients/work
	Research into end-user wants/needs	Exceeding client expectations	Client satisfaction
	Client education	Identification of value from client perspective	Disputes with client
	Monitoring client satisfaction	More client involvement	End-user satisfaction
	Respect for client		
	Sensitivity to client/customer's needs		
Process & team integration	Communication	Trust	No. of disputes
	Collaborative working	Cooperation	No. of claims
	Attitudes towards work & others	No-blame culture	Harmonious relationships
	Task organisation	Participation	
	Participation	Good information sharing & management	
	Team focus	Production of all relevant documentation	
	Dealing with conflicts	Integration	
	Openness		
	Buck-passing (blame culture)		
Delivering quality	Insight, innovation & adaptation	Right first time	Cost
	Learning	No defects	Time

Industry problems	Related Dimensions	Goals & objectives	Potential performance measures
	Performance measurement	Reduced cost-in-use	Quality of product
	Speed & degree of feedback	Innovate new methods	Quality of service
	Waste elimination	Learning from projects	Reworking
	Delivery on time	Deliver on time	New methods/techniques developed
	Delivery within budget	Deliver within budget	Amount of learning (Kululanga *et al.*, 2001)
	Elimination of defects		
Commitment to people	Respect & Support for workforce	Fair wages	Labour turnover (Guest *et al.*, 2003)
	Training	Decent site conditions	Absenteeism
	Motivational conditions	Development of employees	Industrial action
	Health and safety	No accidents/injuries/deaths	No. of accidents (fatal/non-fatal)
	Sustainability & Environmental awareness	Sustainable products & protection of the environment	Employee satisfaction
	Site tidiness	Respect for people (Egan, 1998)	Productivity
	Subcontracting	Retention of people	Environment
	Recognising performance	Diversity	
			Overall performance

5.3.3.2 Questionnaire development

Being the main data collection tool, the questionnaire was designed to be 'respondent-friendly' in order to maximise the response rate, which is widely recognised as being particularly low in construction management research (Xiao, 2002). It is well known that proper questionnaire design is vital for successful data collection (Babbie, 1992; Fellows and Lui, 1997; Creswell, 2003). Considerable effort was therefore devoted towards this endeavour.

As indicated earlier, the unit of analysis in this research was the construction project. In order to obtain all the data required to address the research hypotheses, information on already completed projects was required. The questionnaire was therefore developed with an invitation to participants to use their most recently completed construction project as the frame of reference for responding to the survey. The rationale for targeting most recently completed projects was that on such projects, complete data can be collected to enable a reasonably accurate assessment of performance to be made especially as some of the performance measures are output based and retrospective (Dainty *et al.*, 2003). Besides, such projects would also still be relatively fresh in the minds of respondents, making it relatively easier for them to recall their experiences thus minimising the potential distortions. This is consistent with Borman (1978), Tsui and Ohlott (1988) and Weekley and Gier (1989). Retrospective data collection designs according to Ogbonna and Harris (2002) are a valid and reliable means of gaining insight into organisational phenomena. Ogbonna and Harris (2002) and Anderson (2003) are examples of research that have utilised such designs in investigating the phenomenon of culture. Questionnaire items were therefore directed towards unearthing facts and views of respondents about these projects. The questionnaire survey was designed primarily to elicit information on the kind of cultures that exist within construction project organisations and information on performance outcomes so that relationships between them can be explored using appropriate statistical techniques.

The questionnaire was in four parts. The first section requested general personal information about the respondent. The second section asked respondents to provide information about the most recently completed construction project on which they had direct operational involvement. This section was based on the literature review and interviews in regards to factors influencing the culture of a CPO. In exploring the various cultures that have developed within CPOs, this section was intended to provide data for contextualising and categorising the various cultural orientations found.

The third section requested details about the performance of the project. The specific indicators assessed were based on those identified in Table 5.2. These performance indicators were chosen in accordance with the theory of task performance which posits that measures of performance must reflect the desired goals/objectives (Ankrah and Proverbs, 2005). By identifying the project objectives in respect of the key dimensions of organisational culture, it was possible to identify appropriate performance indicators (Table 5.2) which then formed the basis of the questions in this section of the questionnaire survey. In the analysis of the relationships between organisational culture and construction project performance, the performance measures were to be considered as the dependent variables to be correlated with the independent cultural variables.

The last section requested the respondents' opinion on the culture that existed within the CPO on the project. The questions addressed the key dimensions of culture identified in the interviews conducted with various construction professionals. There were three parts to this section of the questionnaire, and these parts assessed the three aspects of attitudes and perceptions, behaviours and situational contexts respectively in compliance with the social cognitive theory (Parajes, 2002; Cooper, 2000). From the data collected therefore, indexes were to be constructed for each dimension of culture bringing together the relevant questions from each of these three parts. These indexes were then to be employed as measures of culture and used as the independent variables in the statistical analysis of the relationships between organisational culture and project performance. With this data, it will be possible to explore and categorise the cultures of CPOs, and to develop appropriate typologies for the cultures within CPOs.

The various sections and questions in the questionnaire reproduced in Appendix D, were therefore all relevant for the statistical analyses. In total, the questionnaire contained 165 items.

In developing this questionnaire, questions were deliberately constructed to include both close ended and open ended questions, and measurements also included the range of nominal, ordinal, and scale measurements. The variety was to provide flexibility in questionnaire design, and to avoid monotony and make the questionnaire more interesting for respondents as suggested by Babbie (1990). In the main however, close ended questions with ordinal scales were employed to make the questionnaire as easy to complete as possible. The layout and format of the questionnaire was also given a lot of consideration to maximise response and to ensure that respondents did not inadvertently miss questions (*ibid*). Instructions were also provided generally and at the beginning of each section for completing the questionnaire. Once developed, the questionnaire was ready for testing.

5.4 PILOT SURVEY

In order to evaluate the clarity and comprehensiveness of the questionnaire, as well as the feasibility of the survey as a whole, a pilot survey was conducted. As argued by several researchers like Munn and Drever (1990), such test run surveys are necessary to demonstrate the methodological rigor of a survey.

The sample used in this survey was drawn primarily from a database of contractors/builders in the West Midlands maintained by the School of Engineering and the Built Environment (SEBE), University of Wolverhampton, and also included participants who had earlier been interviewed as part of the qualitative study which informed the development of the questionnaire itself. A total of 54 organisations were sent questionnaires to complete in this survey.

5.4.1 Respondent characteristics

Of the 54 pilot questionnaires sent out to the selected sample, 18 were returned representing a response rate of 33.33%. This compares favourably with the 20% response rate achieved in the pilot survey reported in Xiao (2002). Of the respondents, 72.2% represented main contractors, 16.7% worked on their projects as consultants and the remaining 11.1% were engaged as subcontractors (Figure 5.5).

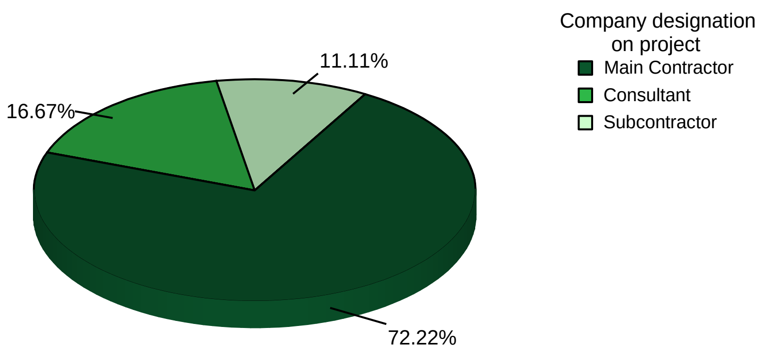

Figure 5.5 Company designation on construction project for pilot survey

Some of the positions reported by respondents included Health & Safety Manager, Project Coordinator, and Project Manager, which is evidence that these respondents are capable of providing the information requested in the questionnaire.

5.4.2 Impact of analysis on questionnaire development for main survey

As a result of the analysis of the pilot survey, the questionnaire was taken through a process of revision to make it more suitable for the main questionnaire survey. From the feedback provided by respondents, the average time taken to complete a questionnaire was approximately 24 minutes. It was therefore considered unnecessary to reduce the overall number of questions in the questionnaire to make it shorter.

Three questions were withdrawn completely because all respondents gave exactly the same response, or did not provide an adequate response at all. An example was a question on whether there were incidents/threats of industrial action on the project. All respondents replied in the negative.

Three new questions were introduced to help with the assessment of project performance. These were questions on:

- Number of design variations;
- Number of times called back during the defects liability period; and
- Satisfaction with project profitability.

Some of the questions on the dimensions of culture were also re-worded as the feedback from the respondents seemed to suggest that they found them ambiguous. This was confirmed by the reliability analysis (using Cronbach's alpha) and the Friedman test which was applied to test for significant differences in the ranking of related measures of cultural orientation (Kinnear and Gray, 2004). Having satisfied the requirement to pretest the questionnaire (cf. Babbie, 1990; Munn and Drever, 1990; Czaja and Blair, 1996) and having completed the revision of the questionnaire, it was ready for deployment in the main survey.

5.5 SAMPLING FOR MAIN SURVEY

As indicated in Babbie (1990), sampling is necessary because of the constraints of time and cost. In this research, the target population is UK contractors (as defined in Chapter 2) and it is well known that UK contractors exceed 175K. In Chapter 2 it was reported that there were 176K private contractors in the UK as at the year 2004 (DTI, 2005). Because it was impractical to collect data from all 176K contractors in the population, sampling was necessary to make the survey possible.

Following the examples of Soetanto *et al.* (2001) and Xiao (2002), the sampling frame that was adopted for the selection of the sample was the list of contractors registered in the UK Kompass (2006) register. In order to determine a suitable size for the sample, the following formula from Czaja and Blair (1996) and Creative Research Systems (2003) was applied:

$$ss = \frac{z^2 \times p(1-p)}{c^2}$$

Where:

ss = sample size

z = standardised variable

p = percentage picking a choice, expressed as a decimal

c = confidence interval, expressed as a decimal

As with most other research, a confidence level of 95% was assumed (Munn and Drever, 1990; Creative Research Systems, 2003). For 95% confidence level (i.e. significance level of $\alpha = 0.05$), $z = 1.96$. Based on the need to find a balance between the level of precision, resources available and usefulness of the findings (Maisel and Persell, 1996), a confidence interval (*c*) of ±10% was also assumed for this research. According to Czaja and Blair (1996), when determining the sample size for a given level of accuracy, the worst case percentage picking a choice (*p*) should be assumed. This is given as 50% or 0.5. Based on these assumptions, the sample size was computed as follows:

$$ss = \frac{1.96^2 \times 0.5(1-0.5)}{0.1^2}$$

$$ss = 96.04$$

Therefore the required sample size for the questionnaire survey is 96 contractors. However, this figure requires a further correction for finite populations. The formula for this is given in Czaja and Blair (1996) as:

$$\text{new } ss = \frac{ss}{1+\frac{ss-1}{pop}}$$

Where:

pop = population

$$\text{new } ss = \frac{96.04}{1+\frac{96.04-1}{176000}}$$

$$\text{new } ss = 95.99$$

The sample size still remains approximately 96 contractors. The UK construction industry is notorious for poor response to questionnaire surveys. 20 – 30% is believed to be the norm (Takim *et al.*, 2004). For this reason it was necessary to adjust the sample size to account for non-response. Assuming a conservative response rate of 20%, the appropriate sample size to be surveyed was calculated as:

$$\text{survey } ss = \frac{\text{new } ss}{\text{response rate}}$$

$$\text{survey } ss = \frac{96}{0.20} = 480 \text{ contractors}$$

A random selection of contractors from the Kompass (2006) directory was thus made to provide a list comprising at least 480 contractors by generating random numbers in Microsoft Excel 2003.

5.6 THE MAIN SURVEY

The sample used in the survey was drawn from a database of contractors listed in the UK Kompass (2006) register. A total of 497 questionnaires were mailed out to participants for completion in this survey.

Three steps were followed in administering the survey to encourage a good response. The first involved a mail-out of an advance-notice letter to all the members of the sample notifying them of the questionnaire they were to be receiving shortly and encouraging their participation. The second step was a mail-out of the actual questionnaire with an accompanying personalised, signed cover letter and a self-addressed reply envelope (Babbie, 1990). This was undertaken about one week after the advance-notice letter as recommended in Creswell (2003). The final step involved a mail-out of another set of questionnaires to all non-respondents, again with an accompanying personalised, signed cover letter and a self-addressed reply envelope. This was also undertaken, as recommended in Creswell (2003), about three weeks after the second step. Although the literature suggests two follow-up mail-outs to ensure high response rates (Babbie, 1990; Creswell, 2003), resource limitations meant that only one follow-up could be undertaken.

5.6.1 Response rate

Of the 497 questionnaires despatched to the selected sample, 67 were returned. When this was combined with the responses from the pilot survey, an overall response rate of 15.42% was achieved (Table 5.3). It is reported in Takim *et al.* (2004) that the response rate norm for postal questionnaire surveys is 20 – 30%. Other sources that support this view include Black *et al.* (2000) which reported a response rate of 26.7% for a questionnaire survey conducted, stating that response rates in this region in construction industry surveys are not unusual at all. Although the response rate of 15.42% obtained in this survey appears to be on the low side compared with these other sources, this should be weighed against the comprehensiveness of the questionnaire which contained about 165 questions (refer to Appendix D). Indeed, lower response rates in the region of 14.7% and 11.6% have been described as the "norm" for comprehensive questionnaires (Soetanto *et al*., 2001). Sutrisna (2004) even reported a response rate of 8.82%.

The combination of the pilot and main survey responses was considered acceptable as projects captured in both cases were across the UK. Moreover only three questions were significantly altered following the pilot, implying that to a large extent the instrument used in both cases was the same.

Table 5.3 Main survey response rate

	Distributed	Received	%
Pilot	54	18	33.33
Main Survey	497	67	13.48
Overall	551	85	15.42

All the questionnaires had been sufficiently completed and therefore they were all included in the data analysis that was subsequently carried out.

5.6.2 Margin of error

It is widely recognised and accepted that for inferential statistical analysis to be undertaken, a large sample is required. It is also generally accepted that as a rule of thumb, any sample with size greater than the threshold of 30 (n > 30) should be considered as a large sample (Munn and Drever, 1990; Sutrisna, 2004). Therefore the sample size of 85 obtained in this survey was considered adequate for the purpose of inferential statistical analysis.

When the margin of error based on the 85 responses was computed (refer to Appendix E), an estimate of 10.63% margin of error due to sampling was obtained at 95% confidence level. This can be interpreted as meaning that there is a 95% probability that results obtained from this survey lie within a ± 10.63% range.

5.6.3 Respondent profile

Of the respondents, 76.5% represented Main Contractors, 16.5% worked on their projects as Subcontractors, 3.5% were engaged as Consultants and the remaining 3.5% were Project Managers and Construction Managers (Figure 5.8).

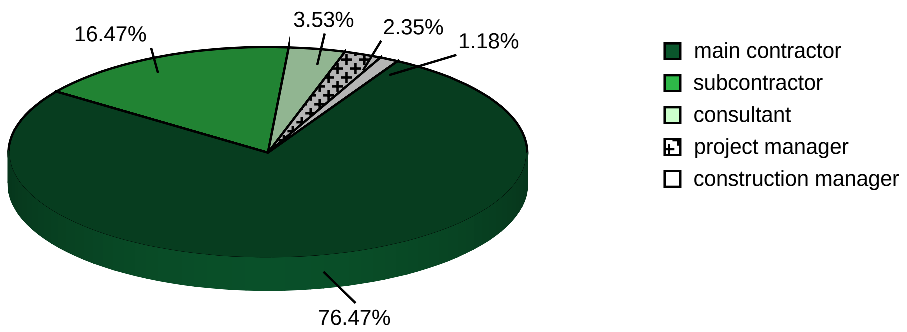

Figure 5.6 Company designation on construction project

Positions reported by respondents included Managing Director, Project Manager, Quantity Surveyor and Contracts Manager among others. These positions are evidence of the fact that the respondents are in the position to provide the information requested in the questionnaire.

Analysis of the data was undertaken using SPSS v13.

5.6.4 Data editing

The responses received from participants contained some missing data. Indeed it is the exceptional study that has no missing data (LoPresti, 1998). Missing data can be problematic in analysis and occurs for many reasons. According to LoPresti (*ibid*), in reputable studies, analysis of missing data is required to improve the validity of the study. Therefore to end up with a good data set and to be able to use all the data collected in the analysis, some time was spent investigating and resolving the missing data problem.

The SPSS v.13 Missing Values Analysis option was used to analyse the patterns of missing data (Appendix F). It was decided after Hair *et al.* (1998), that where missing data levels were not excessively high (in the order of 50% or more) cases and variables would not be excluded from analysis. The only variable with a high percentage of missing values was *Delay* (90.6%). This was the case because this particular question was a follow up question to a previous question and was not applicable to most of the respondents. Where appropriate, the Replace Missing Values option was used to replace the missing values with the mean of all valid responses. Whilst several different options exist for replacing missing values, substitution with the mean is one of the most widely used (Xiao, 2002). This is so because it is considered as the best single replacement value (Hair *et al.*, 1998). Besides, it is easy to calculate and effect the replacement hence its use in this study. To check appropriateness of this approach, the *regression* method and the *estimation-maximization* (EM) method were also used to estimate alternative replacement values (refer to Appendix F). The series means calculated were consistent with these estimates, especially the regression estimates and were therefore accepted.

Further editing of the data was also required to organise it in a format suitable for analysis. For example the scale data representing Contract Price and Project Duration were transformed into categorical data. New variables for Cost Performance and Time Performance were also computed.

5.6.5 Sample splitting

Because of the model development anticipated towards the latter phases of the data analysis, and the requirement for model validation prior to the drawing of conclusions (Good and Hardin, 2003), a proportion of the data collected was selected and held back for the purpose of the validation. This approach is in line with the second of the three approaches of validation described by Good and Hardin (2003) which specifies the splitting of the sample and using one part for calibration, and the other part for verification. This approach has been described as an effective method of validation when it is not practical to collect new data to test the model (Snee, 1977). In terms of how much is set aside for this purpose, the evidence from other research is rather mixed. Whilst Xiao (2002) set aside 12.20%, Omoregie (2006) set aside 9.03%. This appears to suggest that there is no fixed number or percentage required for validation. The recommendation however in Good and Hardin (2003) and Picard and Berk (1990) is that between a quarter (1/4) and a third (1/3) should be set aside for validation purposes.

25% of the sample was therefore randomly selected in SPSS and excluded from the main analysis. The 25% was equivalent to 21 cases (Table 5.4).

The data was now ready for analysis.

Table 5.4 Number of cases held back for validation purposes

	Questionnaires received	%
Analysed sample	64	75
Held-back sample	21	25
Total	85	100

5.7 SUMMARY

Investigating the relationships highlighted in the conceptual framework requires a consideration of the overall research paradigm within which the research is to be undertaken, and the research methods that are appropriate within this paradigm. This chapter therefore considered the research methodology for this research, and set out arguments in favour of a conciliatory methodology involving both qualitative and quantitative methodologies. In terms of the specific research methods for data collection, interviews and questionnaire surveys were adopted.

A series of semi-structured interviews were conducted with highly experienced construction industry participants in line with the proposed methodology. The data collected reinforced the fundamental relationships conceptualised in the model. The model thus provided an appropriate basis for the development of the questionnaire. The questionnaire was designed to capture project characteristics, measure cultural orientation and measure performance. In measuring cultural orientation, the questionnaire was designed to reflect Bandura's social cognitive theory by addressing attitudes and perceptions, goal-directed behaviour, and situational conditions associated with the various dimensions of culture identified through the interviews. The measures of performance incorporated in the questionnaire design were also in line with Takim *et al*. (2003) which argued that performance measures should be associated with the goals and objectives associated with the dimensions of culture. These considerations were all reflected in the questionnaire. Within culture research in construction, this approach is novel and represents a significant departure from the norm.

Following a successful pilot of the questionnaire (33.33% response rate), minor modifications were made to the questionnaire based on the feedback, and the major survey was conducted on a randomly selected sample of contractors listed in the UK Kompass (2006) register. Altogether, 85 sets of data were generated representing an overall response rate of 15.42%. A majority of the respondents were main contractors on the projects they described. Following editing of the data to make it suitable for analysis and splitting of the sample, the data was ready for analysis using SPSS v13.

The following chapters present the results of statistical analyses undertaken on the data to assess the characteristics of the projects covered by the survey, and to diagnose the cultures of the CPOs and evaluate their performance. The statistical analysis techniques applied are also discussed along with their limitations and assumptions.

CHAPTER 6: PROJECT CHARACTERISTICS AND THE CULTURE OF THE CONSTRUCTION PROJECT ORGANISATION

6.0 INTRODUCTION

As indicated in the previous chapter, the questionnaire queried respondents on the characteristics of the projects they were engaged on and the attitudes and perceptions, behaviours and conditions that prevailed on the construction project. The discussions following will thus outline the characteristics of the projects making up the sample to set the context, and also present an analysis of the data on cultural orientations of these CPOs. By so doing, this chapter partially achieves the fifth objective of this research which was to establish the cultural orientations of CPOs in the UK. Further evaluation to draw out differences in the cultural orientations of the CPOs is also presented, the intention being to address the first of the three hypotheses that was developed from the conceptual framework which proposed that there are significant differences in the cultural orientations of CPOs. An evaluation of the relationships between the cultural orientations and the project characteristics is also undertaken to assess the role of the antecedent states as suggested by the conceptual framework.

6.1 STATISTICAL PROCEDURES AND ANALYSES

As can be seen from the questionnaire (Appendix D) there was a mixture of nominal, ordinal and scale data. A variety of statistical procedures were therefore employed in the analyses of the data starting with basic descriptive statistics to more complex procedures like the Freidman test, factor analysis, cluster analysis and analysis of correlations between the variables. The descriptive statistics encompassed frequency distributions, measures of central tendency such as means, medians and modes, and measures of dispersion such as the standard deviation. These were employed to develop a thorough understanding of the nature of the data and to provide summary descriptions of the projects in the sample.

Where appropriate, tests were carried out on the significance of the findings. Such tests included the chi-square (χ^2) test and the Friedman test. The chi-square test is a non-parametric procedure that tabulates a variable into categories and computes a chi-square statistic to test the hypothesis that the observed frequencies do not differ from their expected values. This goodness-of-fit test compares the observed and expected frequencies in each category to test either that all categories contain the same proportion or user-specified proportions of values (SPSS, 2004). Where the intention was to detect significant relationships between some of the nominal variables, the Pearson χ^2 test was applied in cross-tabulations of the variables (Kinnear and Gray, 2004). For the ordinal data, the Friedman test was applied to test for significant differences in the ranking of related variables (*ibid*). This is a non-parametric test for multiple related samples. Such nonparametric tests make no assumptions about the data and are especially appropriate for small samples and can be used with ordinal test variables (Field, 2000), hence their appropriateness for this research.

Factor analysis is a multivariate statistical technique for examining the underlying structure or the structure of interrelationships (or correlations) among a large number of variables (Hair *et al.*, 1998). This analysis yields a set of factors or underlying dimensions which, when interpreted and understood, describe the data in a parsimonious but more meaningful number of concepts than the original individual variables (*ibid*). This approach was utilised in the seminal work of Hofstede (2001) on culture.

Because of the data reduction intention, a suitable method for extraction of factors is principal components analysis, with the extracted components used to compute new variables for subsequent analyses.

Another useful technique that was adopted for the analysis of data was cluster analysis. This technique allocates a set of subjects (in this case CPOs) to a set of mutually exclusive, exhaustive groups in such a way that the subjects within a group are similar to one another while subjects in different groups are dissimilar (SPSS, 2004). This technique was particularly useful for categorising the CPOs into mutually exclusive typologies of culture.

Where there was a need to compare groups of cases for differences in their means along particular variables, analysis of variance (ANOVA) was carried out. ANOVA is a technique for testing simultaneously whether two or more population means are significantly different. Although one-way ANOVA is the method of choice when testing for differences between multiple groups, it assumes that the mean is a valid estimate of centre and that the distribution of the test variable is reasonably normal and similar in all groups (Field, 2000). Where it was not possible to show clearly that these assumptions are satisfied, nonparametric procedures such as the Kruskal-Wallis and Mann-Whitney tests were used to test for the significance of the differences between the mean ranks of the various groups (i.e. whether or not the values of a particular variable differ between two or more groups). The Kruskal Wallis test is a one-way ANOVA by ranks. It tests the null hypothesis that multiple independent samples come from the same population, i.e. have the same mean rank (SPSS, 2004). The Mann-Whitney test is a non-parametric ANOVA similar to the Kruskal-Wallis, but is applied where there are only two groups to compare (Field, 2000). Unlike standard ANOVA, these tests do not assume normality, and can be used for ordinal variables (SPSS, 2004).

A final statistical procedure applied to assess the existence of relationships between variables was the test of correlation. In this case as the data to be tested included ordinal or dichotomous nominal data, the non-parametric Spearman's correlation coefficient was calculated. This test first ranks the data and then applies the Pearson's equation to compute the correlation coefficient. The equation to compute correlation coefficient (r), is given by Field (2000) as:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{(n-1)S_x S_y}$$

Where:

x and y are any pair of variables whose level of correlation is being sought

$\bar{x}$ and $\bar{y}$ are the means of x and y respectively

S_x and S_y are the standard deviations of x and y respectively.

Correlations measure how variables or rank orders are related. It is useful for determining the strength and direction of the association between two variables which could be positively related, not related at all or negatively related (Field, 2000). The correlation coefficient (r) lies between –1 and +1. If the r is close to –1 or +1, the two variables are close to a perfect linear relationship, and when the r is close to 0, there is little or no correlation (*ibid*).

6.2 PROJECT CHARACTERISTICS

Various issues relating to projects were assessed because of their potential influence on the type of culture that develops within the construction project organisation as argued in Ankrah *et al.* (2005b). Analyses of these project characteristics are presented below.

6.2.1 Project type

Table 6.1 summarises the types of projects that were captured in the questionnaire survey (refer to Appendix G for detailed output). As can be seen from Table 6.1, the projects were classified *inter alia* on the basis of client and type of facility constructed. The number of cases in each category is shown together with the percentage equivalent, and the total volume of output for each category as expressed in percentage terms. In terms of the number of projects captured in the survey, private sector new work in the building category constituted the biggest proportion of projects. Majority of these projects were either housing or commercial facilities.

Table 6.1 Project characteristics

Project type	Projects surveyed (Nr)	Projects surveyed (%)	Value of construction output (£mill)	Value of construction output (%)
Proj_type1				
Public	24	43	117.76	60
Private	32	57	76.49	40
Total	56	100	194.25	100
Proj_type2				
New work	34	61	136.27	75
Refurbishment	16	28	23.17	13
Redevelopment	5	9	17.71	10
Demolition	1	2	4.31	2
Total	56	100	181.46	100
Proj_type3				
Civil Engineering	10	19	149.30	56
Building	44	81	118.84	44
Total	54	100	268.14	100
Proj_type4				
Commercial	13	25	39.47	23
Industrial	7	13	10.45	6
Housing	13	25	23.64	14
Infrastructure	6	11	59.61	35
Leisure	3	6	2.28	1
Education	3	6	7.81	4
Mixed use	6	11	11.37	7
Health	2	4	16.85	10
Total	53	100	171.48	100

6.2.2 Complexity

Respondents were asked to give an assessment of the level of complexity of the project. This characteristic of projects was considered important because it emerged from the interviews conducted that where participants considered projects to be complex, they were more willing to work collaboratively to problem-solve and complete the project successfully. As shown in Figure 6.1, almost 61% considered their projects to be either simple or moderately complex. Median rating for project complexity on the scale of 1 to 5 was found to be 3 (Table 2, Appendix G).

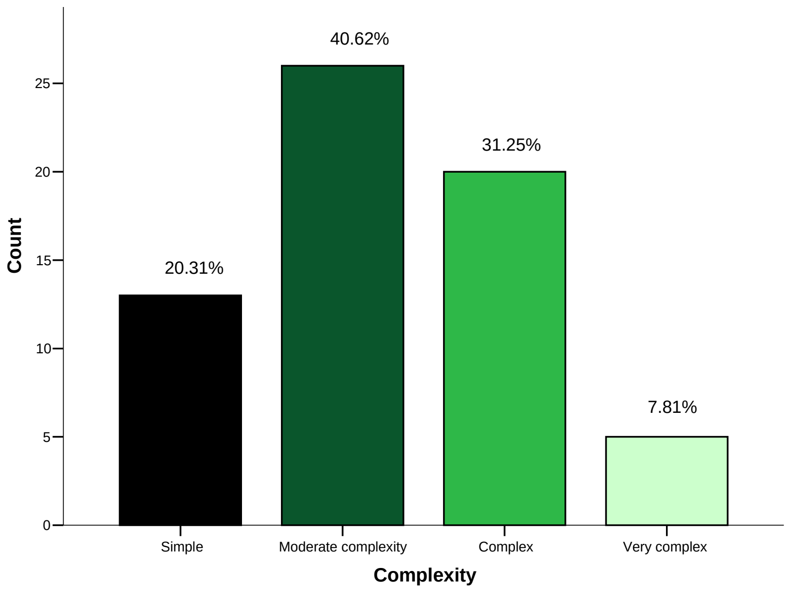

Figure 6.1 Frequency distribution of respondents on the variable complexity

6.2.3 Location

In terms of location, Figure 6.2 shows that the projects under analysis were scattered across the entire UK. Every region is represented in the data collected, with the West Midlands being the single most highly represented region with 21.9%. Greater London and the South East together contribute some 25% of all the projects assessed. This is not unexpected considering the fact that Greater London and the South East together account for around 36% of all construction output by value in the UK (DTI, 2005).

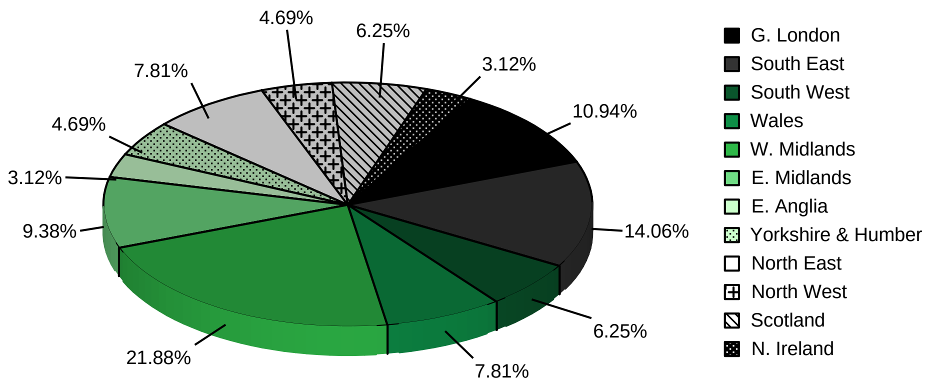

Figure 6.2 Locations of projects

6.2.4 Procurement

In terms of procurement routes adopted on the 64 projects representing the sample, the Traditional lump sum route dominated as the most popular procurement approach with 40.62% of the projects procured this way. Following this with 29.69% is the Design and Build approach. Partnering or Framework Agreements was the approach for procuring 20.31% of the projects with the remaining procurement approaches, including Management Contracting, Construction Management, Remeasurement, the NEC Target Cost Contract, the Enhanced Managing Agent Contract (EMAC) and Private Finance Initiative (PFI) each representing 1.56% of all projects assessed.

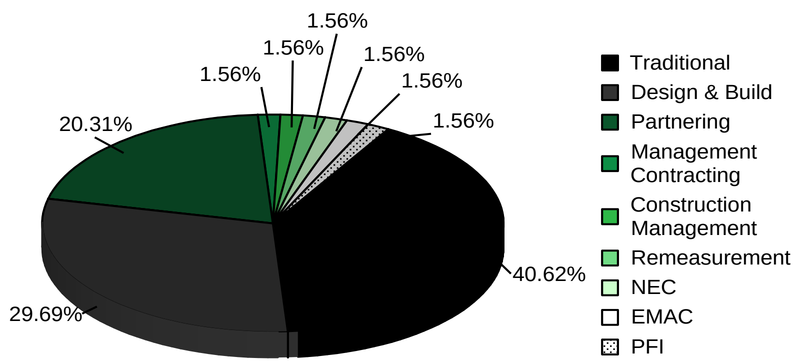

Figure 6.3 Number of projects by procurement route

The chi-square (χ^2) test was conducted on these procurement types to test the null hypothesis that they are equally distributed in the population. The output shown in Tables 3 and 4 (Appendix G) show clearly that the differences suggested by Figure 6.3 are highly significant and not due to chance ($\chi^2 = 106.438$, $p < 0.005$). This implies that there is very strong evidence to show that some procurement approaches are more popular than others. Although this profile differs somewhat from survey findings reported for the year 2004 in an RICS report (RICS, 2006), it does reflect the general trend that the traditional lump sum procurement approaches and the Design and Build routes are still the most popular in UK construction.

6.2.5 Contract price

The mean contract price for the projects was found to be £4.81M with a large standard deviation of £12.88M. The size of this standard deviation clearly shows that the mean does not represent a good model of the survey data (Field, 2000). In cases like this, the median is a preferable statistic (Fellows and Lui, 1997), which from Table 6.2 was found to be £1.23M. This value is a reasonable comparison to the £1.30M that was obtained in RICS (2006). It can also be seen from Table 6.2 that contract prices are spread across a range from a low of £15K to a maximum of £100M. This reflects a fundamental characteristic of construction as an industry which is responsible for delivering simple jobbing projects and at the same time, also responsible for delivering mega projects.

When categorised into bands (i.e. when the scale data is converted to ordinal data as shown in Table 5 of Appendix G), a more useful picture emerged. Table 6.2 shows that the mean is 3.95 (and median is 4.00) corresponding to a mean (and median) contract price between £0.86M and £2.00M, which is consistent with findings in RICS (2006).

Table 6.2 Contract price of projects surveyed

		Contract price (million)	Contract price (million) (Banded)
N	Valid	64	64
	Missing	0	0
Mean		4.8127	3.95
Std. Error of Mean		1.61013	.254
Median		1.2250	4.00
Mode		.40	1
Std. Deviation		12.88101	2.035
Minimum		.02	1
Maximum		100.00	7

6.2.6 Contract duration

From Table 6.3, it can be seen that contract duration has a mean value of 12.13 months with a large standard deviation of 10.59 months. Clearly like the contract price, this statistic is not very useful. Here also, durations range from a low of 0.75 months (3 weeks) to a maximum of 60 months, consistent with the wide range of contract prices. The median duration which is the more useful statistic in this case is 9.75 months. This is consistent with DTI (2005). When banded into the categories shown in Table 6 (Appendix G), the median duration (and also mean duration) was found to be 9 – 12 months.

Table 6.3 Duration of projects surveyed

		Project duration (months)	Project duration (months) (Banded)
N	Valid	64	64
	Missing	0	0
Mean		12.1311	3.86
Std. Error of Mean		1.32322	.252
Median		9.7500	4.00
Mode		9.00	3(a)
Std. Deviation		10.58578	2.015
Minimum		.75	1
Maximum		60.00	7

a Multiple modes exist. The smallest value is shown

6.2.7 Average number of workers on site

The bar chart of the average number of workers on site on a typical day (Figure 6.4) shows that 40.62% of the projects had between 10 and 29 people on site daily. This class was also the median class as shown in Table 7 (Appendix G). Along with contract sum and project duration, the number of workers on site is another measure of project size which as argued in Ankrah *et al*. (2005b), has implications for communication and control mechanisms.

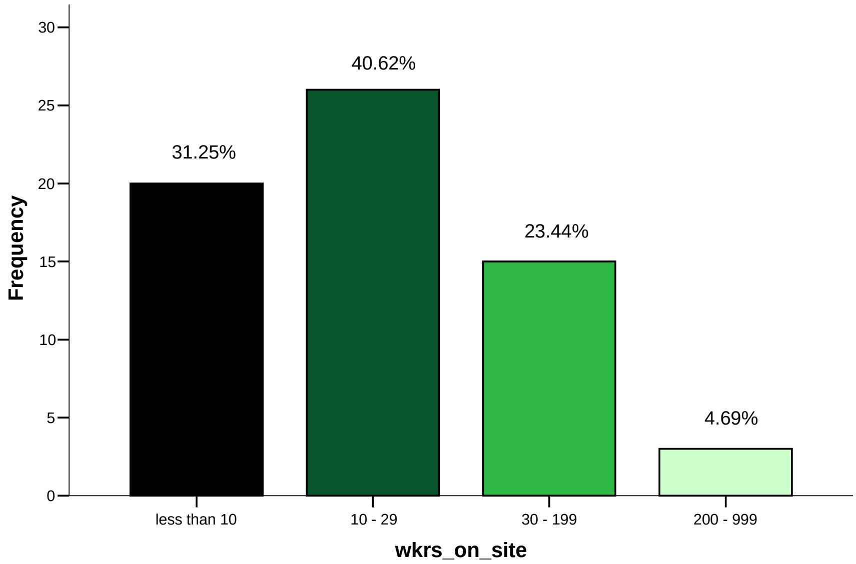

Figure 6.4 Average number of workers on construction site

6.2.8 Previous work with client

66.67% of the projects involved participants who were working with a client they had worked with before (Table 6.4). This is important as it clearly indicates that there has been some history between the parties in as many as two-thirds of the cases. This finding is significant as it is widely argued that history has a significant impact on cultural outcomes (Kotter and Heskett, 1992; Thompson, 1993; Handy, 1995; Mullins, 2005).

Table 6.4 Previous work with client

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	42	65.6	66.7	66.7
	No	21	32.8	33.3	100.0
	Total	63	98.4	100.0	
Missing	System	1	1.6		
Total		64	100.0		

6.2.9 Involvement in design

The high level of involvement in design (55.74%) shown in Table 6.5 below suggests that even for projects procured through the traditional route and routes other than the Design and Build approach, participants like the main contractor and subcontractor are still involved in the design. This is confirmed by Table 8 (Appendix G) which cross-tabulates procurement route and involvement in design. The output shows among other things that even on five traditionally procured projects, the respondents (main contractor and subcontractors) were involved in the design.

Table 6.5 Involvement in design

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	53.1	55.7	55.7
	No	27	42.2	44.3	100.0
	Total	61	95.3	100.0	
Missing	System	3	4.7		
Total		64	100.0		

6.2.10 Influence of participants

An examination of Table 6.6 below showing the mean levels of influence of project participants shows that generally the principal participants are the main contractor, client, project manager, architect, quantity surveyor and civil engineer, in that order, with the main contractor being the most influential of all the project participants with a mean rating of 4.36 and standard deviation of 0.847. This seems to be consistent with the literature (cf. Egan, 1998; Xiao, 2002) which identifies the main contractor as the principal participant and the main driver of the project.

The Friedman test was employed to establish the significance of the differences shown in Table 6.6. The output obtained (Table 6.7), indicates clearly that there is a significant difference between the levels of influence of these key participants ($\chi^2 = 60.456$, $p < 0.000$). The differences in the levels of influence of the various participants are not just due to chance.

Table 6.6 Level of influence of project participants

		Infl_arch	Infl_ce	Infl_qs	Infl_client	Infl_mc	Infl_pm
N	Valid	57	53	57	60	55	51
	Missing	7	11	7	4	9	13
Mean		3.09	2.66	2.77	3.82	4.36	3.51
Std. Error of Mean		.194	.179	.164	.144	.114	.191
Median		3.00	3.00	3.00	4.00	5.00	4.00
Mode		3(a)	1	3	4	5	4
Std. Deviation		1.467	1.300	1.239	1.112	.847	1.362
Minimum		1	1	1	1	1	1
Maximum		5	5	5	5	5	5
Rank		**4**	**6**	**5**	**2**	**1**	**3**

a Multiple modes exist. The smallest value is shown

Table 6.7 Friedman test on levels of influence of project participants

							Friedman Test Statistics			
	Infl_arch	Infl_ce	Infl_qs	Infl_client	Infl_mc	Infl_pm	N	χ^2	df	Asymp. Sig.
Mean Rank	3.12	2.43	2.74	3.96	4.96	3.78	41	60.456	5	.000

6.2.11 The performance ethos

Participants were asked to rank cost, time, quality, and health and safety (H&S) in order of priority on their respective projects with 1 representing topmost priority or most important and 4 representing the least important.

In terms of the mean ranking (Table 6.8), it appears that on construction projects generally, contrary to popular belief, cost is not the most important consideration. Cost ranks third behind H&S which is ranked as the most important and quality which is ranked second most important. This is clearly at variance with Xiao (2002) which reported the performance ethos of UK construction projects to be in the order cost-quality-speed. This result may be indicative of the changing attitudes and culture of the construction industry in respect of H&S. It may also be indicative of the effectiveness of the H&S legislation and bodies like the Health & Safety Executive (HSE) in dealing with organisations that fail to meet their H&S commitments. Indeed, accidents and injuries and fatalities in the construction industry are declining and this may be attributable in part to this changing ethos.

Table 6.8 Priority levels for various project objectives

		Prior_cost	Prior_time	Prior_qual	Prior_hands
N	Valid	64	64	64	64
	Missing	0	0	0	0
Mean		2.29	2.84	2.05	1.90
Std. Error of Mean		.136	.145	.127	.146
Median		2.00	3.00	2.00	1.00
Mode		1	4	1	1
Std. Deviation		1.090	1.158	1.015	1.164
Minimum		1	1	1	1
Maximum		4	5	4	4
Rank		**3**	**4**	**2**	**1**

There is however agreement between the results and the literature (cf. Xiao, 2002) that time is the least important consideration. The performance ethos is thus H&S–quality–cost–time.

Here also, the Friedman test was applied to these rankings in order to test the significance of these findings. The Friedman procedure tests the null hypothesis that multiple ordinal responses come from the same population. The data may come from repeated measures of a single sample or from the same measure from multiple matched samples. For a constant sample size, the higher the value of this chi-square statistic, the larger the difference between each variable's rank sum and its expected value. The output from SPSS is shown in Table 6.9.

Table 6.9 Friedman test on project priorities

					Friedman Test Statistics			
	Prior_cost	Prior_time	Prior_qual	Prior_hands	N	χ^2	df	Asymp. Sig.
Mean Rank	2.52	3.05	2.26	2.16	64	21.359	3	.000

From this output it can be seen that there is a large chi-square value (χ^2 = 21.359, $p < 0.000$) implying that there is strong evidence to reject the null hypothesis that there is no difference in the priority placed on the different objectives project organisations pursue. Clearly, the levels of priority placed on the various objectives are significantly different from each other, and H&S is the most important objective that most project organisations pursue.

6.3 SUMMARY OF PROJECT CHARACTERISTICS

Most of the projects captured in this survey were private sector new work in the building category, specifically housing and commercial building projects. This outcome is not surprising for a nationwide survey of this nature considering the fact that according to the Construction Statistics Annual (DTI, 2005), the private sector accounts for some 67% of all construction output, new work accounts for about 53%, building projects make up about 77%, and housing constitutes about 40% of construction output in the UK. Most of these projects were considered by respondents to be either moderately complex or simple, where complexity is a measure of the difficulty of executing the individual parts of the construction project and/or bringing these parts together in a unified whole (Gidado, 1996). This makes sense considering the range of projects that contractors undertake from simple jobbing projects to very complex mega projects.

In terms of the locations of these projects, all the UK regions were well represented, and a majority of these projects (41%) had been procured by traditional procurement arrangements. This finding is consistent with RICS (2006) which also found that in the UK, as at 2004 the traditional procurement approach was the most popular procurement route followed by the Design and Build approach. Contract prices ranged from £15K to £18M with contract durations from three weeks to five years. This is also a reflection of the range of projects undertaken in the construction industry. Median (and mean) value of the projects was found to be between £0.86M and £2.00M, consistent with RICS (2006), with the median (and mean) duration found to be within the range of 9 – 12 months, which is not too dissimilar from figures provided in DTI (2005). In terms of the average number of workers on site, 10 – 29 workers each day was found to be the median class. Not surprisingly, the Main Contractor was reported as the most influential participant overall. The performance ethos of UK construction project organisations was found to be in the order H&S–quality–cost–time with H&S as the most important and time as the least important. As argued earlier, this seems to suggest a shift in priorities from what obtains traditionally as reported in Xiao (2002) where cost is considered as the most important objective.

It can be concluded from the above findings that generally the sample is representative, or at least broadly reflective, of construction projects in the UK. Projects of all kinds, procured under different arrangements, and across the entire UK are represented in the sample.

6.4 AN ANALYSIS OF THE RELATIONSHIPS BETWEEN PROJECT CHARACTERISTICS

To assess the nature of inter-relationships between the project characteristics, Spearman's correlation was applied to the project characteristics. The Spearman's correlation coefficient was considered appropriate as the variables involved were a combination of scale, ordinal or dichotomous nominal data. The correlation matrix produced is shown in Table 8 (Appendix G). From Table 8 (Appendix G), it can be seen that many of the project characteristics are inter-related. Altogether, these relationships paint an interesting portrait of construction projects in the UK. Summarising the key findings from this matrix, it can the seen that there is a strong positive association between contract price, project duration, average number of workers on site, actual out-turn cost and the actual duration. These associations are logical as these parameters are all fundamentally measures of the size and scale of the project. The association between these measures and project complexity and number of variations implies that the bigger the project, the more complex it is likely to be and the greater the number of design variations that are likely to occur. This is also consistent with conventional wisdom. The bigger projects are the public sector new work projects within the civil engineering category. Such projects are associated with greater influence of the civil engineer and the quantity surveyor. Significantly the bigger a project gets (non-housing projects), the greater the priority on cost relative to the other objectives, and the lower the emphasis placed on quality. One other significant relationship is the negative association between the priority of cost and the priority of H&S which suggests that as more emphasis is placed on cost, there is less emphasis on H&S. Bearing in mind the finding that there is greater emphasis on cost for the bigger non-housing projects, it would appear to suggest that both quality and H&S concerns are replaced by cost concerns as the project becomes bigger in size.

These projects which manifest the relationships highlighted above represent the context within which the cultural orientations to be examined have developed. They also represent the sort of projects for which the inferences to be drawn from the subsequent analyses can be considered valid.

6.5 DIAGNOSING THE CULTURE OF CPOs

In trying to diagnose the culture of CPOs in the UK based on the questionnaire responses, composite indexes were constructed for the various dimensions of culture. This was primarily because of the adoption of the social cognitive theory (SCT) approach of reciprocal determinism (Wood and Bandura, 1989; Pajares, 2002) which implied that each dimension of culture was addressed by three questions covering the cognitive, behavioural and situational aspects (refer Chapter 4). Such indexes ensure that more comprehensive and more accurate assessments of orientations on variables are obtained (Griffith *et al.*, 1999). Babbie (1990) argues that where single questionnaire items give only a crude assessment on a given variable, such composite measures are preferable. Moreover, it is argued that such additive indexes reduce the random error by averaging the individual random variations to zero when summed across all items (Griffith *et al.*, 1999).

6.5.1 Index construction

A number of requirements, as spelt out in Babbie (1990) had to be satisfied in the construction of the indexes. Firstly, items presented in the negative on the questionnaire had to be converted to the positive so that all items would read in the same direction or context. Secondly, to ensure valid measurements, face validity was required. Each item included in the index had to appear (at least superficially) to be related to the variable it was purporting to measure. Only items satisfying this requirement were selected for the construction of the indexes. Lastly there was a need for unidimensionality, in that a composite measure should only represent one dimension. Therefore no questionnaire item was included in more than one of the indexes.

6.5.2 Index scoring

Babbie (1990) argued that equal weighting should be applied unless there were compelling reasons for the application of differential weighting. Therefore, in the analysis undertaken, equal weighting was applied to the items in the composite index. Each respondent was thus assigned an overall score representing the mean of the scores received on individual items as per

Babbie (*ibid*). In this study where each index was made up of three questionnaire items, the three items were each allocated a 33.33% weighting.

Scoring the indexes in this manner gave a theoretical range of scores from a minimum of 1 to a maximum of 5, with 1 representing a very low orientation on the dimension and 5 representing a very high orientation. 37 indexes (dimensions of culture) were generated in this manner. Appendix H shows the individual questionnaire items making up the indexes.

6.5.3 A profile of the general cultural orientation of CPOs

Descriptive statistics for the 37 dimensions of culture were produced (Table 6.10). The measure of central tendency employed was the mean, although the median would theoretically have been the more accurate measure because the data was ordinal. However as explained in Hofstede (2001) the mean was used as the nature of the data was such that the mean is a close estimate of the median. This is borne out by the results in Table 6.10. The mean is also easier to determine and interpret, and can be employed in various other calculations. Besides, as in the case of Hofstede (2001) the data scales used in this study i.e. very important to not important, and strongly agree to strongly disagree, can be considered quasi-interval scales, implying that the mean is a reasonable and valid measure.

A web chart of the means, representing the mean cultural orientations of CPOs along the various dimensions, is shown in Figure 6.5.

These findings are also summarised in simpler terms in Table 6.11. The lowest rated dimension was *blame culture* (T8) which was rated low. The fact that it was not rated very low implies that a certain level of finger-pointing still exists. This is in keeping with the reputation of the construction industry which is notorious for having a blame culture. This finding suggests that there is still some scope for improvement in this regard.

Table 6.10 Descriptive statistics for the dimensions of culture

		N	Mean	Std. Deviation	Std. Error of Mean	Median	Mode	Min	Max
Leadership									
L1	Access and approachability	64	4.3428	.62349	.07794	4.3333	5.00	2.33	5.00
L2	Supportiveness & appreciation	64	3.6836	.62165	.07771	3.6667	3.67	1.67	5.00
L3	Control of workers' behaviour	64	3.4772	.72656	.09082	3.4933	3.67	1.33	5.00
L4	Participation	64	3.1855	.71952	.08994	3.0583	3.00	1.33	5.00
L5	Keeping operatives informed	64	3.3783	.69176	.08647	3.3333	3.00	1.00	5.00
L6	Communication	64	3.6248	.72156	.09020	3.6667	3.33	1.33	5.00
Commitment to client									
C1	Contact & communication	64	4.1628	.82449	.10306	4.3933	4.67	1.67	5.00
C2	Research into end-user needs	64	3.6514	.85097	.10637	3.6667	4.00	1.00	5.00
C3	Educating client	64	3.5547	.77440	.09680	3.6667	3.33	1.00	5.00
C4	Monitoring satisfaction	64	3.8692	.70714	.08839	4.0000	3.67	1.67	5.00
C5	Precedence of client's needs	64	3.7758	.70012	.08752	3.8250	3.00	2.00	5.00
C6	Respect for client	64	4.3585	.66087	.08261	4.3450	5.00	1.67	5.00
Team ethos									
T1	Collaborative working	64	3.9376	.61493	.07687	4.0000	3.67	1.67	5.00
T2	Trust	64	3.6426	.64985	.08123	3.6667	3.67	1.67	5.00
T3	Emphasis on teamwork	64	3.5779	.67629	.08454	3.6667	3.33	1.67	5.00
T4	Dealing with conflict by compromise	64	3.5393	.67027	.08378	3.3333	3.33	1.00	5.00
T5	Information sharing	64	3.9186	.63630	.07954	4.0000	4.33	2.00	5.00
T6	Identification with project	64	3.1908	.60410	.07551	3.3333	3.33	2.00	4.67
T7	Free & open communication	64	3.7713	.70551	.08819	3.6667	3.33	1.00	5.00
T8	Blame culture	64	2.0543	.72033	.09004	2.0000	2.33	1.00	5.00
Project delivery									
P1	Innovation	64	2.8790	.65257	.08157	3.0000	2.67	1.00	4.67
P2	Learning on project	64	3.3913	.57186	.07148	3.3333	3.67	1.33	4.67
P3	Monitoring performance	64	3.4561	.56732	.07092	3.3333	3.00	2.00	5.00
P4	Providing performance feedback	64	3.5143	.63832	.07979	3.6667	3.67	1.67	5.00
P5	Waste elimination	64	3.3603	.63522	.07940	3.3333	3.00	2.33	5.00
P6	On-time delivery	64	3.9301	.56497	.07062	4.0000	4.33	2.67	5.00
P7	Driving down cost	64	3.4799	.58688	.07336	3.5917	4.00	2.06	5.00
P8	Quality & getting it right first time	64	3.9436	.60384	.07548	4.0000	4.00	2.67	5.00
P9	Environmental friendliness	64	3.5842	.69838	.08730	3.5833	3.00	1.00	5.00
Commitment to workforce									
W1	Subcontracting	64	3.4023	1.06815	.13352	3.5000	4.67	1.00	5.00
W2	Showing concern for workers	64	4.2158	.62017	.07752	4.3333	4.00	2.00	5.00
W3	Respect for all workers	64	4.0710	.67815	.08477	4.3333	4.33	1.67	5.00
W4	Motivating workforce	64	3.5126	.62419	.07802	3.6633	3.33	1.33	5.00
W5	Training	64	3.5754	.83398	.10425	3.6667	4.00	1.00	5.00
W6	Safeguarding health & safety	64	4.2222	.67718	.08465	4.3333	5.00	2.00	5.00
W7	Site tidiness	64	3.8578	.70174	.08772	3.7767	3.67	2.00	5.00
W8	Recognising good performance	64	3.3116	.80290	.10036	3.3333	2.67	1.00	5.00

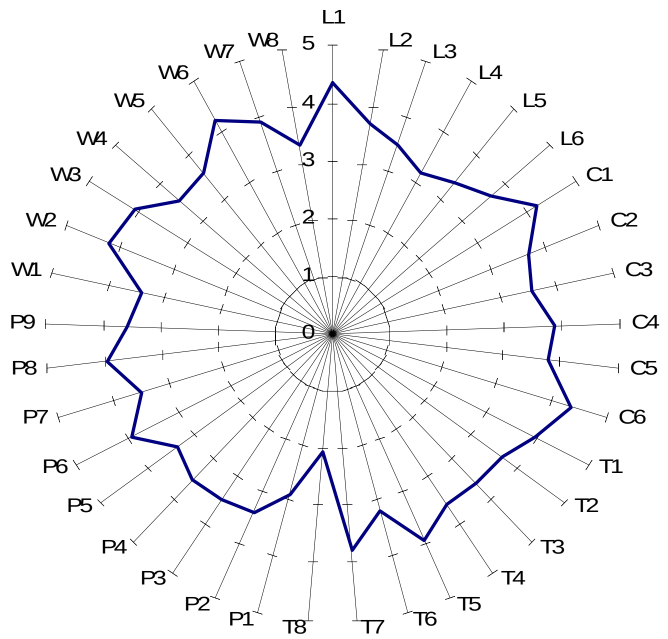

Figure 6.5 The overall cultural profile of CPOs

The orientations of CPOs on the dimensions of *control of workers' behaviour* (L3), *participation of all participants in planning & goal-setting* (L4), *keeping operatives informed* (L5), *identification with project* (T6), *innovation* (P1), *learning on project* (P2), *monitoring performance* (P3), *waste elimination* (P5), *driving down cost* (P7), *subcontracting* (W1) and *recognising good performance* (W8) were all neutral. It would have been expected that with all the reports and research commissioned to address the poor performance of the construction industry (cf. Latham, 1994; Egan, 1998), the cultural orientation in respect of dimensions like *monitoring performance, waste elimination* and *driving down costs* would have been very high with project participants conscientiously striving to achieve better performance. This is clearly not the case, suggesting that improvements are possible in this regards. The remaining dimensions were all rated high. Significantly, no dimension of culture scored very high. Using the generic classifications of the dimensions as shown in Table 6.11, a general cultural profile of CPOs is discussed below.

Table 6.11 Overall level of cultural orientation

Code	Dimension	Mean	Std. Deviation	Level of cultural orientation				
				Very high	High	Neutral	Low	Very low
Leadership								
L1	Access and approachability	4.3428	.62349		✓			
L2	Supportiveness & appreciation	3.6836	.62165		✓			
L3	Control of workers' behaviour	3.4772	.72656			✓		
L4	Participation	3.1855	.71952			✓		
L5	Keeping operatives informed	3.3783	.69176			✓		
L6	Communication	3.6248	.72156		✓			
Commitment to client								
C1	Contact & communication	4.1628	.82449		✓			
C2	Research into end-user needs	3.6514	.85097		✓			
C3	Educating client	3.5547	.77440		✓			
C4	Monitoring satisfaction	3.8692	.70714		✓			
C5	Precedence of client's needs	3.7758	.70012		✓			
C6	Respect for client	4.3585	.66087		✓			
Team ethos								
T1	Collaborative working	3.9376	.61493		✓			
T2	Trust	3.6426	.64985		✓			
T3	Emphasis on teamwork	3.5779	.67629		✓			
T4	Dealing with conflict by compromise	3.5393	.67027		✓			
T5	Information sharing	3.9186	.63630		✓			
T6	Identification with project	3.1908	.60410			✓		
T7	Free & open communication	3.7713	.70551		✓			
T8	Blame culture	2.0543	.72033				✓	
Project delivery								
P1	Innovation	2.8790	.65257			✓		
P2	Learning on project	3.3913	.57186			✓		
P3	Monitoring performance	3.4561	.56732			✓		
P4	Providing performance feedback	3.5143	.63832		✓			
P5	Waste elimination	3.3603	.63522			✓		
P6	On-time delivery	3.9301	.56497		✓			
P7	Driving down cost	3.4799	.58688			✓		
P8	Quality & getting it right first time	3.9436	.60384		✓			
P9	Environmental friendliness	3.5842	.69838		✓			
Commitment to workforce								
W1	Subcontracting	3.4023	1.06815			✓		
W2	Showing concern for workers	4.2158	.62017		✓			
W3	Respect for all workers	4.0710	.67815		✓			
W4	Motivating workforce	3.5126	.62419		✓			
W5	Training	3.5754	.83398		✓			
W6	Safeguarding health & safety	4.2222	.67718		✓			
W7	Site tidiness	3.8578	.70174		✓			
W8	Recognising good performance	3.3116	.80290			✓		

6.5.3.1 Leadership

Although there are strong arguments in favour of a more committed leadership orientation (cf. Egan, 1998; Liu *et al.*, 2003; Kashiwagi *et al.*, 2004; Chan and Chan, 2005) because of its motivational function, and the contribution it makes to minimising inefficiencies and engendering improved performance, the results of this survey seem to suggest an indifference in leadership orientation corroborating Egan's (1998) assertions that there is a lack of widespread evidence of the commitment of leadership. Although there is generally a high orientation in respect of access and approachability of management staff, supportiveness and appreciation, and communication, there is also a neutral orientation in respect of control of workers' behaviour, participation of all participants in planning and goal-setting, and keeping operatives informed. All these dimensions can be improved.

6.5.3.2 Commitment to client

Although it is widely believed that in construction, there is a tendency to focus on the next job and the next employer which detracts from a focus on the current client (Egan, 1998), this research suggests that there is still a relatively high orientation in respect of all the dimensions relating to commitment to client. CPOs exhibited a generally high orientation on the dimensions contact and communication, research into end-user needs, educating client, precedence of client's needs, respect for the client, and monitoring client satisfaction. Given that client focus is important for performance improvement (Egan, 1998; Dainty *et al.*, 2005), it is reasonable to suggest that CPOs need to further improve orientations to a very high level.

6.5.3.3 Team ethos

A fundamental characteristic of the construction industry is the extensive fragmentation within the CPO (cf. Latham, 1994; Harvey and Ashworth, 1997; Egan, 1998; Fellows *et al.*, 2002; Cain, 2004). It is widely believed that this fragmentation has negative impacts on project delivery (cf. Latham, 1994; Egan, 1998). With the high orientations found among CPOs in this survey in respect of the dimensions of collaborative working, trust, emphasis on teamwork, dealing with conflict by compromise, information sharing, and free and open communication, and the low orientation in respect of blame culture, it would appear to suggest that project participants are taking on board the messages advocating greater integration. The level of identification with the project was however rated neutral overall. In all these aspects, there is room for further improvement.

6.5.3.4 Project delivery

The orientation of CPOs on the dimensions in this area was mixed. Whilst orientations were high in respect of providing performance feedback, striving for on-time delivery, quality and getting it right first time, and environmental friendliness, orientations in respect of the dimensions innovation, learning on project, monitoring performance, emphasising waste elimination, and striving to drive down cost, were all neutral. This finding is consistent with the suggestion that the selection of designers and constructors on the basis of lowest cost instead of overall value for money undermines the interest of some project participants in improving their orientations in respect of these dimensions of culture (cf. Littlefield, 1998; Cain, 2004).

6.5.3.5 Commitment to workforce

As argued earlier there is still a problem in construction of recognising that its people are its greatest assets and hence a need to invest in their training and development, health and safety, decent site conditions, and fair wages (Egan, 1998; Fellows *et al.*, 2002; Pearce, 2003). This is borne out by the findings which show a high (rather than very high) cultural orientation in respect of the dimensions of showing concern for workers, respect for all workers, motivating workforce, safeguarding health and safety, and site tidiness, and a neutral cultural orientation in respect of the dimensions subcontracting, and recognising good performance. With the exception of the dimension subcontracting which fundamentally assessed the degree of utilisation of direct labour or subcontractors, it would have been expected that if people are indeed the "greatest assets" (Fellows *et al.*, 2002), then there should be a very high orientation in respect of all these dimensions. Here also, there is scope for improvement in the cultural profile of CPOs.

These findings in respect of the cultural orientations of CPOs are particularly useful for those seeking change in the culture of the construction industry as it identifies those areas where improvements are possible. Relating this perspective to social cognitive theory, it can be suggested that measures to drive such improvements must address the cognitive aspects, the behavioural aspects and/or the situational contexts within which project participants function. Whether or not such improvements in culture will also improve performance however requires further investigation.

6.6 IDENTIFYING THE UNDERLYING FACTORS

In order to test the factor structure of the 37 dimensions of culture being investigated and to establish the extent to which any underlying factors tally with the *a priori* item classification based on Egan (1998), factor analysis was undertaken. The factor analysis was also to demonstrate convergent and discriminant validity and also to reduce the number of variables to be considered in subsequent analysis.

It has been specified in Hair *et al.* (1998) that the preferable size for factor analysis is 100 cases or more. A common rule of thumb for sample size is a ratio of five to ten cases per variable (Hair *et al.*, 1998; Field, 2000). Some even specify higher ratios (Osborne and Costello, 2004). The sample size of 64 in this analysis which is less than the suggested minimum therefore raises the question of sample size adequacy and whether the application of factor analysis will lead to the extraction of stable factors. However it has also been argued in Field (2000) that under certain circumstances the sample size may not be critical. For instance it has been argued *ibid* that if a factor has four or more loadings greater than 0.6 then it is reliable regardless of sample size. Again, where all communalities are greater than 0.6, samples less than 100 may be perfectly adequate (*ibid*). Communalities obtained in this research are shown in Table 1 (Appendix I). Lowest communality obtained was 0.609. It has also been demonstrated through empirical research (Arrindell and van der Ende, 1985 in Field, 2000) that subject-to-variable ratios made little difference to the stability of factor solutions. The above arguments demonstrate that there is as yet no definitive verdict on what an appropriate sample size for factor analysis should be. The 64 cases in this analysis may therefore well be adequate. Indeed there is even evidence of published research where factor analysis has been performed on similar or much less data (cf. Proverbs *et al.*, 1997; Kaming *et al.*, 1997; Liu, 1999; Leung *et al.*, 2004). Therefore whilst the potential biases associated with a small sample size as highlighted in Lingard and Rowlinson (2006) are noted and whilst recognising also that the debate on sample size is on-going (cf. Hair *et al.*, 1998; Field, 2000; Osborne and Costello, 2004), the application of factor analysis in this research for data reduction purposes was considered acceptable.

To further test the suitability of the data for the factor analysis, two measures – the Kaiser-Meyer-Olkin measure of sampling adequacy (MSA) and Bartlett test of sphericity, were obtained (Table 6.12). These two tests according to UCLA (2006) provide the minimum standard that should be passed. The MSA varies between 0 and 1, with .60 suggested as a minimum (*ibid*). An even lower limit of .50 is suggested in Hair *et al.* (1998) and Field (2000). With the Bartlett test, a significant result is required (UCLA, 2006).

Table 6.12 Tests of the suitability of the data for factor analysis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.776
Bartlett's Test of Sphericity	Approx. Chi-Square	1826.665
	Df	666
	Sig.	.000

From the output presented in Table 6.12, it can be seen that on both counts the data is suitable for factor analysis. The next stage of the analysis saw eight components initially extracted accounting for 73.88% of the total variance in the 37 dimensions of culture (Table 2, Appendix I). The extraction of the eight components was based on the Kaiser criterion which specifies the extraction of all factors with eigen values ≥1 (Field, 2000). It is important to recognise that an exact quantitative basis for the number of factors to extract does not exist (Hair *et al.*, 1998). What exists are a number of criteria outlined in Hair *et al.* (1998) and Field (2000) that are in current use and that are applied subjectively in research. One of these is the Kaiser criterion. According to Field (2000), the Kaiser criterion should not be the only criterion used for factor extraction as its reliability is dependent on the number of variables and the sample size. Indeed the Kaiser criterion is most reliable when variables are between 20 and 50 (Hair *et al.*, 1998), and also where sample size is greater than 250 with average communality greater than or equal to 0.6 (Field, 2000).

An alternative to the Kaiser criterion provided by Hair *et al.* (1998) is the *a priori* criterion where the researcher already knows the desired number of components based for instance on theory. In this research, the literature review and the interview results seemed to indicate five key categories of the cultural dimensions, implying the extraction of five components if this criterion is adopted. Another alternative criterion is the percentage of variance criterion which specifies that for social science research selecting a solution that accounts for 60% of the total variance is satisfactory (*ibid*). In this research, 60% of the total variance coincides with five components as shown in Table 6.13. Indeed the scree plot produced (Figure 6.6) also provides support for a five component solution. The cut-off point for selecting components on a scree plot is the point of inflexion or change of direction (Field, 2000), which on Figure 6.6 is marked by the thunderbolt. This point of inflexion corresponds with five components.

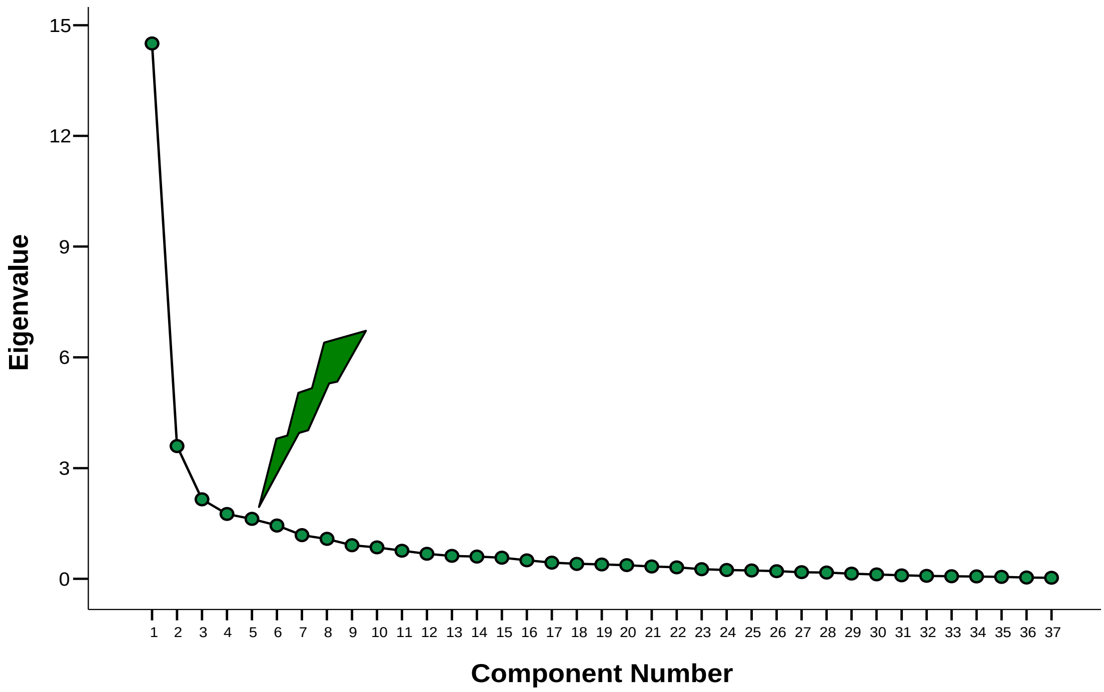

Figure 6.6 Scree plot showing component extraction criterion

Ultimately the aim is to achieve the most representative and parsimonious set of components possible (Hair *et al.*, 1998). Therefore the five component solution was accepted and the analysis was re-run extracting five components. These five components extracted account for 63.863% of the total variance in the 37 dimensions of culture (Table 6.13), and satisfy the '7 ± 2' optimum number of dimensions specified by Miller (1956 in Hofstede and Fink, 2007).

In order to improve the interpretability of factors, varimax rotation was performed on the extracted component matrix. Varimax rotation is one of a number of rotation techniques. It is recommended as a good approach that simplifies the interpretation of factors by maximising the loading of each variable on one of the extracted factors whilst minimising its loading on all the other factors (Field, 2000). The rotated component matrix that was obtained after the varimax rotation is displayed below (Table 6.14).

Table 6.13 Total variance explained by extracted factors

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.506	39.206	39.206	14.506	39.206	39.206	10.176	27.502	27.502
2	3.593	9.712	48.918	3.593	9.712	48.918	4.297	11.615	39.117
3	2.153	5.818	54.736	2.153	5.818	54.736	3.815	10.311	49.428
4	1.756	4.745	59.481	1.756	4.745	59.481	3.295	8.906	58.334
5	1.621	4.382	63.863	1.621	4.382	63.863	2.046	5.529	63.863
6	1.443	3.901	67.763						
7	1.182	3.195	70.959						
8	1.080	2.919	73.878						
9	.909	2.457	76.335						
10	.850	2.297	78.632						
11	.761	2.056	80.688						
12	.675	1.825	82.513						
13	.620	1.677	84.190						
14	.603	1.629	85.818						
15	.571	1.544	87.362						
16	.500	1.350	88.712						
17	.436	1.178	89.890						
18	.404	1.092	90.982						
19	.387	1.047	92.028						
20	.369	.998	93.026						
21	.333	.900	93.926						
22	.310	.839	94.765						
23	.260	.703	95.468						
24	.238	.642	96.110						
25	.223	.601	96.712						
26	.205	.553	97.264						
27	.177	.479	97.743						
28	.168	.455	98.198						
29	.139	.375	98.573						
30	.118	.319	98.892						
31	.093	.250	99.142						
32	.078	.212	99.354						
33	.067	.181	99.535						
34	.062	.166	99.702						
35	.050	.134	99.835						
36	.034	.092	99.928						
37	.027	.072	100.000						

Extraction Method: Principal Component Analysis.

The matrix shows the rotated component loadings. These are the correlations between each variable and the component (UCLA, 2006). For clarity and for interpretative purposes, loadings less than 0.4 were suppressed (Field, 2000). Labelling these new components required an examination of the patterns of component loadings for the variables including their signs (Hair *et al*., 1998), with higher loadings invariably given more weight. The five new components are described in detail in the following subsections.

Table 6.14 Rotated component matrix

		Component				
		1	2	3	4	5
W4	Motivating workforce	0.816				
T3	Emphasis on teamwork	0.803				
T7	Free & open communication	0.757				
W7	Site tidiness	0.755	0.410			
W8	Recognising good performance	0.744				
L5	Keeping operatives informed	0.733				
L4	Participation	0.728				
L6	Communication	0.715				
T4	Dealing with conflict by compromise	0.695				
T1	Collaborative working	0.685				
W5	Training	0.677	0.534			
L2	Supportiveness & appreciation	0.658				
W3	Respect for all workers	0.653				
P9	Environmental friendliness	0.627				
C2	Research into end-user needs	0.618			0.424	
P2	Learning on project	0.607	0.406			
L3	Control of workers' behaviour	0.586				
W2	Showing concern for workers	0.581	0.413			
C6	Respect for client	0.528		0.422	0.458	
W6	Safeguarding health & safety		0.773			
P4	Providing performance feedback		0.651			
P6	On-time delivery		0.611			
P8	Quality & getting it right first time		0.535			
P3	Monitoring performance		0.480			
T8	Blame culture			-0.831		
L1	Access and approachability			0.730		
T5	Information sharing			0.581		
T2	Trust			0.532		
P1	Innovation	0.439		-0.465		
P7	Driving down cost					
C3	Educating client	0.410			0.749	
C4	Monitoring satisfaction				0.683	
C5	Precedence of client's needs			0.473	0.646	
C1	Contact & communication				0.553	
T6	Identification with project					0.716
W1	Subcontracting					-0.568
P5	Waste elimination					0.506

Extraction Method: Principal Component Analysis.
Rotation converged in 24 iterations.

6.6.1 Workforce orientation

All variables on component one were positive indicating that they all vary together. As can be seen from Table 6.13, all the higher loadings relate to the workforce. Variables like motivating workforce (W4), emphasis on teamwork (T3), free and open communication (T7), site tidiness (W7), recognising good performance (W8), keeping operatives informed (L5), participation (L4), and communication (L6) were loaded highly on component one. This component was therefore labelled *workforce orientation*. It is very common to find this dimension (or similar) in empirical studies of organisational culture, as in the very recent study of Zuo and Zillante (2006) on project culture, which found people orientation to be significantly associated with team satisfaction.

Workforce orientation encompasses the amount of effort put into motivating the workforce, emphasis on teamwork, the extent of free and open communication on site, the emphasis on site tidiness, recognition of good performance, keeping operatives informed of project developments, the extent of participation in planning and decision-making by the workforce, communication between managers and operatives, and so on. These elements generally speaking, are not areas for which the construction industry is renowned for exemplifying good practice as found for instance in Riley and Clare-Brown (2001). This is supported by the results shown in Figure 6.5 and Table 6.11, which indicate that the UK construction industry is generally moderate in orientation in respect of aspects like recognising good performance, keeping operatives informed and participation in planning and decision-making, and just above moderate in respect of the other dimensions.

Going by the evidence presented so far, it appears reasonable to suggest that the workforce orientation of construction project organisations can and must be improved, especially as it is universally recognised that these are traits necessary for employee satisfaction and organisational effectiveness (Robbins, 1998; Mullins, 2005).

6.6.2 Performance orientation

Variables on component two were also all positive indicating that they all vary together. Variables highly loaded on this component were safeguarding health and safety (W6), providing performance feedback (P4), on-time delivery (P6), and quality and getting it right first time (P8). All these dimensions assess orientation of CPOs in relation to aspects of delivering projects to specified standards. This component was therefore labelled *performance orientation*. A similar dimension – results orientation, has also been investigated in other studies (cf. Zuo and Zillante, 2006) demonstrating the validity of these results.

Performance orientation encompasses safeguarding H&S, providing performance feedback for continuous improvement, emphasising on-time delivery, and striving for quality delivery and getting it right first time. The profile summarised in Table 6.11 shows that the orientation on all these aspects is high. A high performance orientation is understandable considering the fact that there are direct penalties associated with falling foul of any requirements associated with these dimensions unlike the workforce orientation.

Here also, there is room for further improvement. Dainty *et al.* (2005) report a similar dimension in respect of project management competencies described as achievement orientation, a concern for working well towards a standard of excellence. High-performing project managers' achievement orientations were inevitably directed towards successful project outcomes.

6.6.3 Team orientation

Component three had negative loading on the variables blame culture (T8) and innovation (P1) indicating that they vary together. That is, trying out new ways of executing tasks is associated with a blame culture. The variables access and approachability (L1), information sharing (T5), and trust (T2) were all positively loaded indicating that they also vary together but are oppositely related to the blame culture (T8). All together, the significant loadings give an indication of the *team orientation*.

Team orientation thus encompasses blame culture (or absence of it), the extent to which management is accessible and approachable, amount of information sharing, degree of trust, and to lesser extent the avoidance of innovation. Team orientation is generally high as can be seen from Table 6.11, with a low blame culture across the projects surveyed. This appears to herald an improvement from the time of Shammas-Toma *et al*. (1998) which found a culture dominated by short-term financial considerations and reflected in uncooperative, antagonistic and suspicious relationships with accusations, recriminations and blame, to be common on UK construction sites. Because of the fragmented nature of construction, a high team orientation with better integration, cooperation and coordination of construction project teams is often a prerequisite for project success (Dozzi *et al*., 1996; Cicmil and Marshall, 2005). This is consistent with Baiden *et al*. (2006) who posit that team orientation promotes a working environment where information is freely exchanged between the different participants.

The importance of this orientation has also been emphasized by Dainty *et al.* (2005) which also reported a requirement for teamwork and cooperation competency within project management.

6.6.4 Client orientation

All the variables on component four were positive, indicating that they all vary together. These variables were educating client (C3), monitoring client satisfaction (C4), precedence of client's needs (C5), and contact and communication with client (C1), all clearly making reference to relations with the client. Component four was therefore labelled *client orientation*.

Client orientation thus encompasses the effort put into educating the client, the extent to which client satisfaction is monitored, precedence of client's needs, and the amount of contact and communication between the project organisation and client. It is widely recognised that customer-focus is a precursor to success, and as a result, it has been argued that contractor organisations must be customer-focused, in terms of understanding and fulfilling the expectations of the client (Bryde and Robinson, 2005). In Dainty *et al.*'s (2005) study on the competencies of project managers, high performing managers were found among other tendencies to show a marked propensity for seeking information about the real, underlying needs of clients, beyond those overtly expressed within contractual documents and terms of appointment. They also exhibited a responsible attitude towards dealing with customer service problems rapidly and efficiently (*ibid*). These findings underscore the importance of client orientation. From the data analysed in Table 6.11, client orientation is generally high across the sampled construction projects, reflecting an appreciation of the importance of this dimension. This is in line with the Egan (1998) agenda for change which challenged the industry to show greater commitment to its clients. But there is still some scope for further improvement in this regard as none of the individual dimensions making up client orientation was rated as being very high.

6.6.5 Project orientation

The final component – component five, had one negative loading due to the variable subcontracting (W1) indicating that it varies negatively with the other variables – identification with project (T6) and waste elimination (W5) which both have positive loadings. This could be interpreted as meaning, the greater the level of subcontracting, the lower the level of identification with the project (probably due to the compounded effect of out-group discrimination – drawn from Phua and Rowlinson's (2004) social identity perspective), and the lower the waste elimination orientation. It has been noted in Hsieh (1998) that there is a tendency for subcontracting to divide the CPO into "islands" or self-centred decision-making units with conflicting interests. It has also been noted (*ibid*) that current subcontracting practices are inimical to waste elimination and improved productivity. It is therefore not surprising that the level of subcontracting has been classified with the level of project identification and waste elimination. This component was therefore labelled *project orientation*.

Project orientation thus relates to the extent to which participants identify with the project, the propensity for subcontracting (as opposed to direct labour) and effort put into waste elimination. This orientation can be considered as being moderate across the projects surveyed. Here also there is much room for further improvement, especially as it is recognised as essential for 'project chemistry' (Nicolini, 2002).

The results strongly support the *a priori* classification, with the main difference being the fact that leadership and some of the team ethos elements are now subsumed under workforce orientation. The factor analysis thus provides evidence of construct, convergent, discriminant and face validity of the scales. It can also be argued that orientations are not optimum and that improvements can be made. However this argument can only be sustained if it can be demonstrated that such improvements will lead to better performance outcomes.

New variables were computed from the component score coefficient matrix (Table 3, Appendix I) to represent the five principal dimensions of culture using the Anderson-Rubin option in SPSS (Hair *et al.*, 1998) which produced uncorrelated new standardised variables for use in the subsequent analyses.

6.7 TYPOLOGIES OF PROJECT CULTURE

When dealing with a construct like culture, it is common to find typologies employed to provide a simplified means of assessing cultures (Ankrah *et al.*, 2005c). As defined by Hofstede (2001), typologies describe a number of ideal types of culture, each of them easy to imagine, against which the culture being assessed is compared. Typologies are used as metaphors and have mainly been utilised in studies of organisational culture for their ability to communicate easily a sense of what the culture is. A variety of such metaphors are available in the literature (refer Chapter 3), many derived from the organisational experiences of various authors. Rather than apply these typologies within this study, it is possible to derive typologies of CPO culture statistically from the data collected in the questionnaire survey. This is a more objective approach which makes more sense to the extent that there will be cases (or CPOs) within each derived typology, and it will be possible to describe each typology fully.

A useful statistical technique for deriving these typologies is cluster analysis. Whenever there is a need to classify a "mountain" of information into manageable meaningful piles, cluster analysis is of great utility (StatSoft, 2004). Although there is a range of clustering methods, for this study the hierarchical clustering method was employed. According to Garson (2007a) hierarchical clustering is appropriate for smaller samples (typically < 250). When this analysis was applied to the data, Figure 6.7 was obtained.

This dendrogram (Figure 6.7) obtained by complete linkage, is read from right to left. The number of clusters to be extracted is determined by examining the distances between clusters at each successive step shown in the agglomeration schedule (Table 2, Appendix J). Cluster solutions are defined when the distance measure between steps makes a sudden jump (Hair *et al.*, 1998). On the basis of this criterion, it can be seen from the agglomeration schedule that there is a sudden jump at step 62 corresponding to the three-cluster solution shown on the dendrogram. The three clusters are shown as clusters 1, 2 and 3 on the dendrogram. There is also a five-cluster solution. This solution arises at step 60 of the agglomeration, and results from the sub-division of cluster 3 into three further clusters. These five clusters are indicated on Figure 6.7 as clusters A, B, C, D and E. Indeed clusters A, D and E can each be further sub-divided into two, giving rise to an eight-cluster solution shown on Figure 6.7 as clusters π, ρ, θ, λ, ξ, μ, σ and ω. However, for the purposes of this research, the five-cluster solution was accepted.

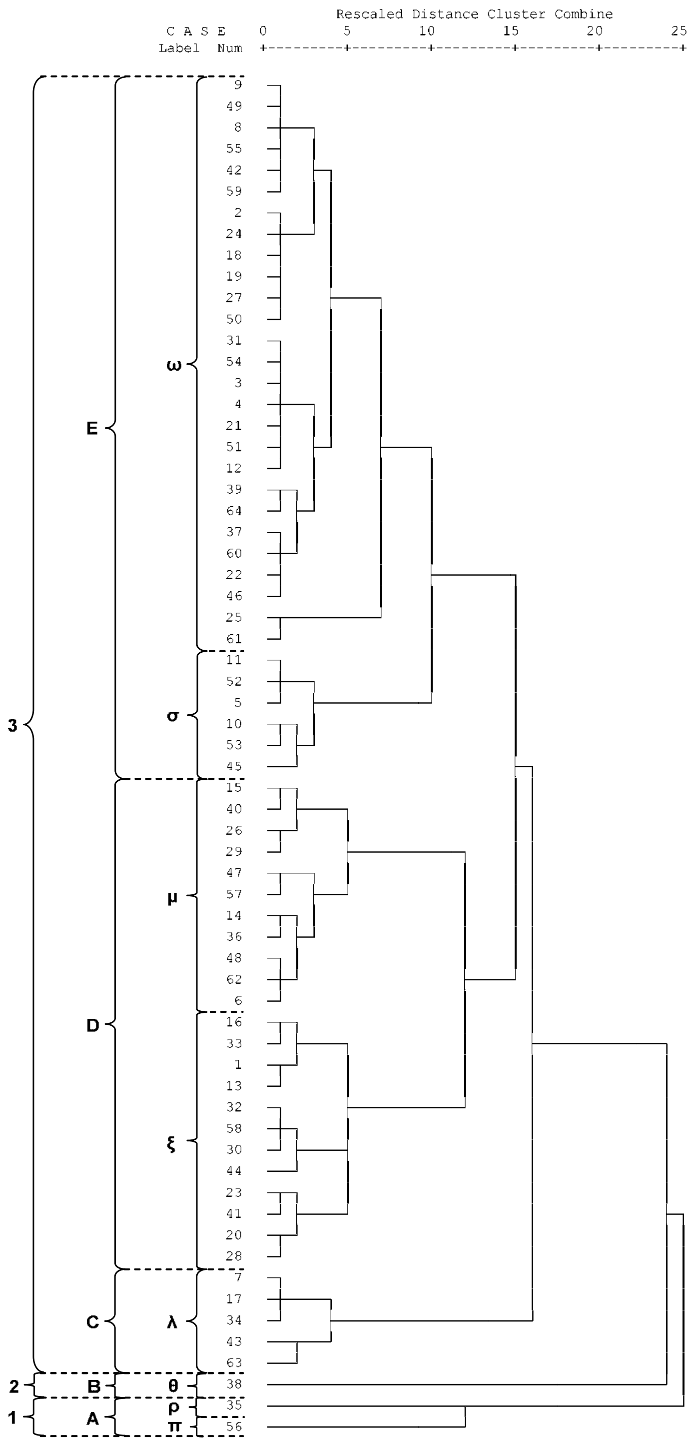

Figure 6.7 Dendrogram of cultural typologies using complete linkage

In simple terms, these clusters that have been identified represent groups of projects that are identical to each other, but distinctly different from projects in other clusters. The clusters may therefore be considered as providing a broad classification of cultural types.

6.7.1 The five-cluster solution

The five-cluster solution gives cluster A comprising CPOs 35 and 56, cluster B comprising CPO 38, cluster C comprising CPOs 7 through 63 as shown on the dendrogram, cluster D comprising CPOs 15 through 28, and cluster E comprising CPOs 9 through 45. The mean orientations of the five clusters were obtained and a web chart was plotted to illustrate the differences in cultures of the five clusters relative to each other and the general orientation (Figure 6.8).

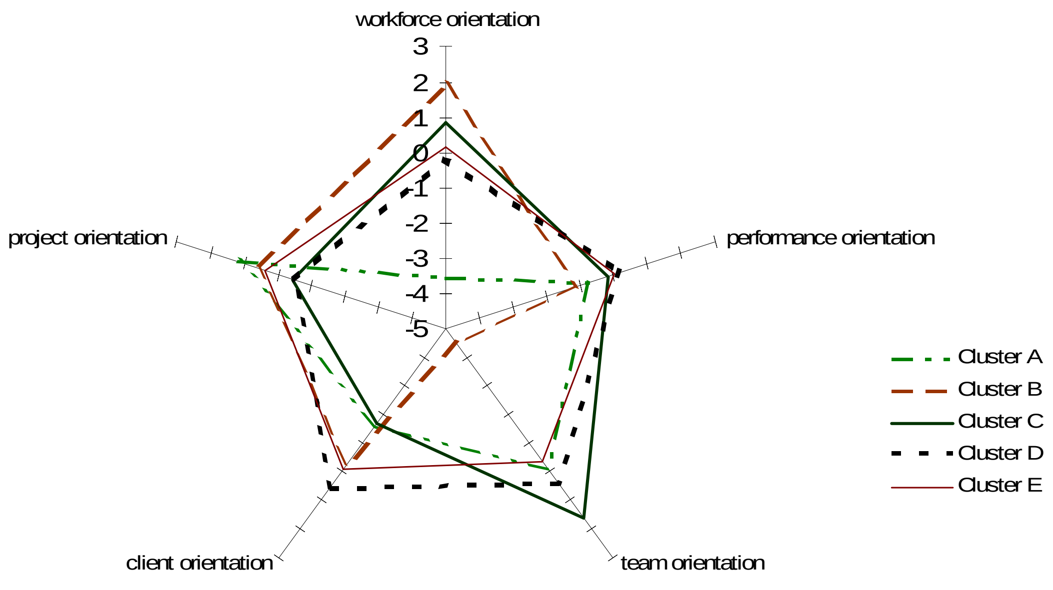

Figure 6.8 Cultural orientations of the five clusters of CPOs

To compare the five clusters among themselves, and to test the significance of the apparent differences shown on the web chart, an analysis of variance (ANOVA) test was carried out. ANOVA is a technique for testing simultaneously whether two or more population means are significantly different, and is appropriate for comparing the orientations of the five clusters. One of the assumptions of ANOVA is that the data is normally distributed. However, tests of normality based on the Kolmogorov-Smirnov and Shapiro-Wilk test statistics showed that some of the dimensions of culture did not conform to the assumption of normality (Table 3, Appendix I). Therefore to assure robust comparisons, the non-parametric Kruskal-Wallis test was employed instead. The output from SPSS is shown in Table 6.15.

Table 6.15 Kruskal-Wallis Test Statistics for differences between clusters

	workforce orientation	performance orientation	team orientation	client orientation	project orientation
Chi-Square	16.212	2.560	30.211	20.844	13.684
df	4	4	4	4	4
Asymp. Sig.	.003	.634	.000	.000	.008

The output shows that there is strong evidence that the five clusters differ significantly along four of the five dimensions of culture. These are the four dimensions of workforce, team, client and project orientations. The difference of the mean orientations of the five clusters plotted on the bar chart shown below (Figure 6.9) indicates that the largest differences are along workforce orientation and team orientation.

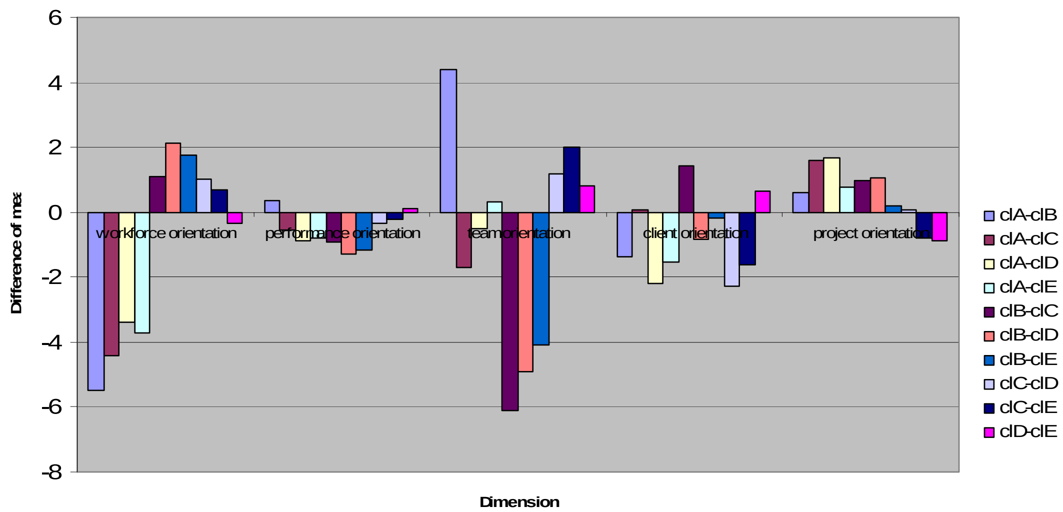

Figure 6.9 Difference of the mean orientations of the five clusters

6.7.2 Profiles of the clusters

Cultural profiles of the five clusters identified through the cluster analysis are discussed below.

6.7.2.1 Profile of cluster A

Relative to the other clusters, cluster A has the lowest workforce orientation, but it has the highest project orientation. This suggests that relatively, CPOs within this cluster do not put as much emphasis and effort into motivating the workforce, teamwork, maintaining free and open communication on site, site tidiness, recognising good performance, keeping operatives informed of project developments, and workforce involvement in planning and decision-making. These CPOs however demonstrate the greatest sense of identification with the project, use of direct labour and emphasis on waste elimination. This cluster also has a relatively low client orientation.

6.7.2.2 Profile of cluster B

Relative to the others, cluster B has the highest workforce orientation but lowest team orientation. This implies that CPOs in this cluster put the greatest emphasis and effort into motivating the workforce, maintaining free and open communication on site, site tidiness, recognising good performance, keeping operatives informed of project developments, and workforce involvement in planning and decision-making. These CPOs however also exhibit much more finger-pointing, less accessible and approachable management, less information sharing, and a lower degree of trust.

6.7.2.3 Profile of cluster C

Cluster C has the highest team orientation, but also has the lowest client orientation. This implies that relatively, CPOs in this cluster put the greatest emphasis and effort into avoiding finger-pointing, more accessible and approachable management, more information sharing, and promoting a higher degree of trust among participants. These CPOs however also put the least effort into educating the client, monitoring client satisfaction, giving precedence to the client's needs, maintaining contact and communication with the client. These CPOs also have a high workforce orientation.

6.7.2.4 Profile of cluster D

Cluster D has the highest client orientation. Together with cluster C this cluster has the lowest project orientation. This suggests that CPOs within this cluster put the most emphasis and effort into educating the client, monitoring client satisfaction, giving precedence to the client's needs, maintaining contact and communication with the client. These CPOs however also have the lowest sense of identification with the project, use of direct labour and emphasis on waste elimination.

6.7.2.5 Profile of cluster E

Relative to the other clusters, Cluster E has a cultural profile that practically coincides with the average orientation along the dimensions of culture assessed. CPOs in cluster E therefore have a culture that is neither higher than average or lower. These CPOs constitute the largest proportion of projects.

These five clusters provide a broad classification of cultural types, and provide evidence that there are indeed significant differences in the cultures of CPOs. This implies that the hypothesis H_1 which proposed that there are significant differences in the cultures of CPOs working on different construction projects in the UK is supported by the empirical evidence.

6.7.3 Implications for project management and performance

It is widely recognised that workforce orientation is necessary for goal commitment, organisational effectiveness and participant satisfaction (Leung *et al.*, 2004; Mullins, 2005), and that key aspects of workforce orientation including a climate of openness and encouragement of employees are factors that support learning (Kululanga *et al.*, 2001). This suggests that CPOs with a high workforce orientation such as those in cluster B are more likely to achieve positive outcomes in terms of learning, goal commitment, effectiveness and participant satisfaction, whilst those in cluster A are more likely to find these outcomes harder to achieve.

Because of the fragmented nature of construction, a high team orientation with better integration, cooperation and coordination has been identified as a prerequisite for project success (Cicmil and Marshall, 2005). It leads to an environment where there is trust, open communication and free exchange of information (Baiden *et al*., 2006). It reduces the propensity for litigation (Fenn *et al.*, 1997) with obvious implications for satisfaction. This implies that CPOs with a high team orientation such as those in cluster C are more likely to experience positive outcomes in terms of 'project chemistry', litigation and participant satisfaction. It is also widely recognised that customer-focus is a precursor to success, and as a result, it has been argued that contractor organisations must be customer-focused (Bryde and Robinson, 2005). In Dainty *et al.*'s (2005) study on competencies of project managers (PMs), high performing managers were found to show a marked propensity for seeking information about the real underlying needs of clients, and for dealing with customer service problems rapidly and efficiently. This implies that unlike cluster C, CPOs with a high client orientation such as those in cluster D are more likely to achieve positive outcomes in terms of client satisfaction and PMs performance.

Higher project orientation implies that project participants identify more with the project, there is less subcontracting, and more effort is put into waste elimination. It has been noted in Hsieh (1998) for instance that there is a tendency for subcontracting to divide the CPO into "islands" with conflicting interests. It has also been noted *ibid* that subcontracting practices are inimical to waste elimination and improved productivity, and that subcontractors are notorious for poor housekeeping. These aspects if not properly attended to, can increase 'opportunities' for accidents and therefore have negative consequences on H&S on site (Sawacha *et al.*, 1999), leading to de-motivation and consequently absenteeism. This implies that unlike clusters C and D, CPOs with a high project orientation (cluster A) are more likely to achieve positive outcomes in respect of waste reduction, productivity and H&S.

These inferences drawn from the literature though speculative, demonstrate the potential positive and negative impacts of having one or other cultural profile, and provide interesting hypotheses that can be examined in the subsequent analyses. Clearly, each typology has cultural orientations that potentially have both positive and negative consequences associated with them. Whilst there is no right or wrong cultural typology, it is important to be aware of the potentially negative orientations so that steps can be taken to mitigate their impacts on project delivery and performance.

6.8 PROJECT-DEPENDENT FACTORS AND THE CULTURE OF CPOs

It was argued in Chapters 4 and 5 that various factors such as leadership, people, project characteristics, procurement and other project arrangements, prioritisation of goals and objectives, and location potentially have a bearing on the culture that develops within a construction project organisation (CPO). Some of these factors thus formed the basis of the contextual information that was collected in the questionnaire survey. It was argued in Ankrah *et al.* (2005b) that such information will be useful in testing for significant differences in the various cultural orientations found. Some of the hypotheses that were put forward *ibid* to help with the testing were that:

- P_1: There are no differences in the cultures of CPOs regardless of their composition.
- P_2: There are no differences in the cultures of CPOs irrespective of the characteristics of the projects on which they are engaged.

P_3: There are no differences in the cultures of CPOs irrespective of who dominates and drives the project.

P_4: There are no differences in the cultures of CPOs regardless of the method of procurement employed.

P_5: There are no differences in the cultures of CPOs irrespective of the prioritisation of goals and objectives.

P_6: There are no differences in the cultures of CPOs irrespective of where the project is located.

Whilst the data collected did not permit the testing of all these propositions, some of them were put to the test using the Kruskal-Wallis and Mann-Whitney tests where the variables involved were nominal, and Spearman's correlation where the variables involved were ordinal or scale. Each of the five dimensions of culture was tested and the results are presented in Appendix K. Some of the inferences drawn from these results are discussed.

6.8.1 The effect of project characteristics

There was no evidence from the data collected to suggest that the type of client or nature of the project has an effect on the cultural orientation of the CPO. Regardless of whether the project was public or private, new work or repair and maintenance, building or civil engineering, or housing or non-housing, there was no evidence that any of the cultural orientations is different, and therefore no evidence of an effect of project type on culture (refer to Tables 1, 2 and 3, Appendix K).

Project scale as measured by the contract sum showed significant correlation with the performance orientation of the CPO ($\rho = 0.288$, $p = 0.021$). The correlation itself was positive indicating that the higher the contract sum the higher the performance orientation. This finding is reinforced by the correlation between another measure of project scale, in this case the average number of workers on site, and performance orientation ($\rho = 0.255$, $p = 0.042$).

Another project characteristic, complexity, was also found to be significantly correlated with team orientation (ρ = -0.281, p = 0.025), as well as client orientation (ρ = 0.299, p = 0.017). This implies that the more complex a project is, the higher the client orientation but the lower the team orientation.

6.8.2 The effect of dominant participants

For each project, the most dominant participant was identified from the data on levels of influence. A test for differences in cultural orientation for the different dominant groups was then conducted. No significant differences were found as shown in Table 1 (Appendix K). However, the correlation matrix (Table 3, Appendix K) revealed significant association between the level of influence of the quantity surveyor (QS) and performance orientation (ρ = 0.336, p = 0.011), between the level of influence of the client and workforce orientation (ρ = 0.381, p = 0.003), and between the level of main contractor influence and project orientation (ρ = -0.293, p = 0.030). These results suggest that as the quantity surveyor becomes more influential, the performance orientation within the CPO increases; as the client becomes more influential, workforce orientation increases; and as the main contractor becomes more influential, the project orientation of participants suffers.

6.8.3 The effect of procurement

As can be seen from Table 2 (Appendix K), there was no evidence in the data collected to suggest that the type of procurement employed had a significant effect on the type of culture within the CPO. In other words it appears to suggest that the culture within the project organisation (at least in respect of the workforce, performance, team, client and project orientations) is not significantly changed by the procurement route employed. This finding is somewhat surprising as it is widely believed that some procurement routes like partnering lead to greater orientation on such aspects as performance, team and client focus. Indeed this belief was recounted by one of the interviewees in the qualitative phase who even intimated that they;

> *"move people around to meet that client or contractual arrangement"* because *"if you use that contract, you get these behaviours. If you use this contract, you get these behaviours,"* and *"…we can't have people that are used to partnering...and are looking at success and how to make the job successful, in an environment where you've got a client who actually wants us to go out of business"*

It can be inferred from the results that it should not be taken for granted that adopting partnering for instance as a procurement framework would automatically result in a different cultural orientation. Participants need to work at changing the culture through training and development in aspects such as teamwork (Nicolini, 2002).

6.8.4 The effect of project objectives

For each project, the topmost priority was identified from the data on the priority of cost, time, quality and H&S. The Kruskal-Wallis test revealed no evidence of significant differences in cultural orientation regardless of what the topmost priority was. However, the correlation matrix revealed significant association between the level of importance of cost and the level of workforce orientation (ρ = 0.266, p = 0.034). Recalling the fact that on the ordinal scale of project priorities, higher values reflect lower importance, this finding indicates that as cost becomes more important the workforce orientation suffers. The correlation matrix also revealed significant association between the level of importance of H&S and the performance orientation (ρ = -0.295, p = 0.018) and the team orientation (ρ = -0.299, p = 0.016). In other words, as H&S becomes more important performance orientation and team orientation both improve.

6.8.5 The effect of location

The results from the analysis showed significant evidence of differences in project orientation with location of the project regionally (χ^2 = 20.000, p = 0.045). None of the other cultural orientations showed evidence of differences with the project location. To help interpret these results, Figure 6.10 was produced showing mean project orientations for the various regions. Very crudely, it appears there is a north-south divide with projects to the north of the UK generally having a lower project orientation than projects in the south, the exceptions being the North-East and the South-West.

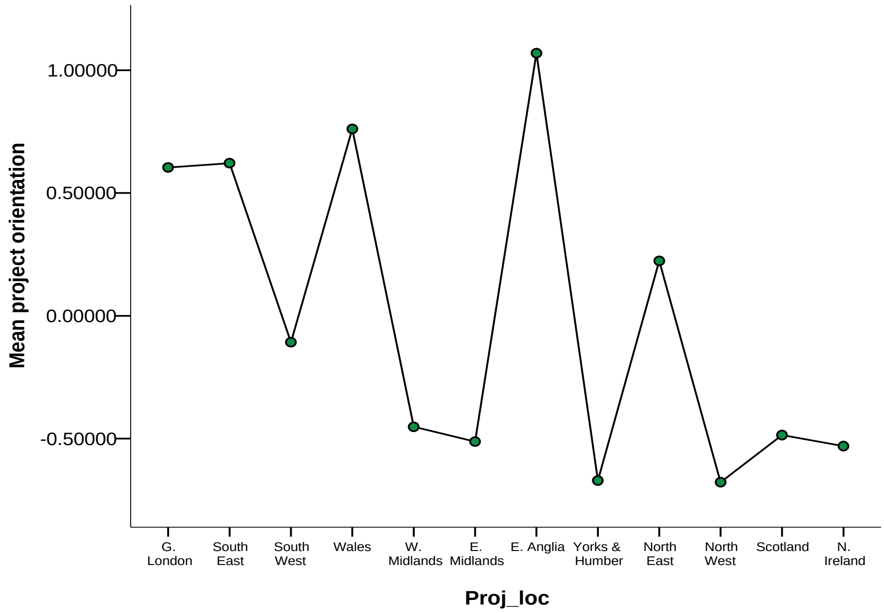

Figure 6.10 Mean project orientation for the different UK regions

6.8.6 The effect of other factors

Beyond the contextual factors discussed above, the analysis also examined the effects of having previously worked with the client, the involvement in design, and the number of design variations. From the Mann-Whitney statistics shown in Table 1 (Appendix K), there was inadequate evidence to suggest that previous work with the client or involvement in design had any effect on the cultural orientations.

The correlation matrix (Table 3, Appendix K) however revealed a significant correlation between the number of design variations and the team orientation (ρ = -0.259, p = 0.039). The negative correlation indicates that an increase in number of design variations is associated with a decline in team orientation.

6.8.7 Discussion of the effects of project-dependent factors

It is clear from the results that some of the contextual factors do have a significant association with the cultural outcomes, in particular, project size, complexity, the influence of participants like the quantity surveyor, client and the main contractor, the level of importance of cost and H&S, location, and the number of design variations.

Project size, as reflected in the contract sum and the number of workers on site was found to be positively associated with performance orientation. As projects grow in size, the project organisation becomes more performance oriented. This is logical as performance orientation deals with the effort to protect people on site, providing all participants with performance feedback so that continuous improvement can be achieved, the emphasis placed on schedule delivery, and the effort put into achieving quality delivery and getting it right first time. The bigger the project, the bigger the likely cost of getting any of these aspects wrong and hence the greater the attention required to ensure that things do not go wrong. This is consistent with the finding that there is greater emphasis on cost on the bigger projects. Moreover, as can be seen from Figure 6.11 the larger projects also coincide with the publicly funded projects where public accountability is required.

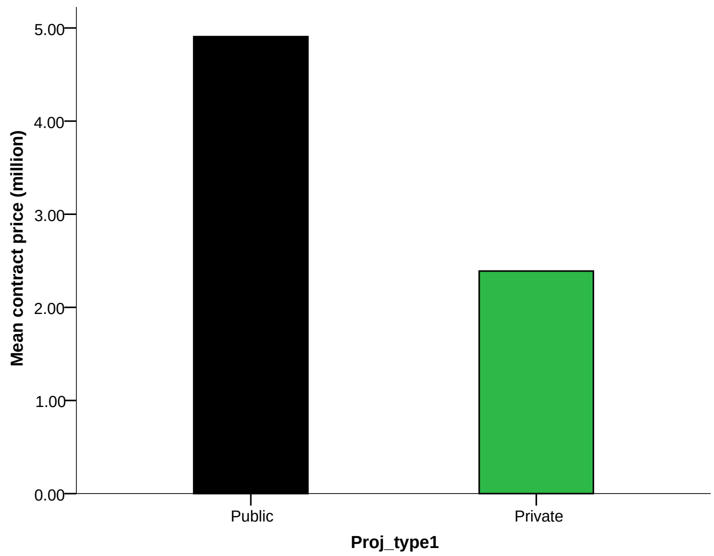

Figure 6.11 Mean contract price for different clients

As project complexity increases, so does client orientation. In its simplest form, project complexity can be viewed as a measure of the difficulty of implementing planned production workflows in relation to the achievement of project objectives (Gidado, 1996). Although this definition is subjective and does not provide a firm basis for a concise and consistent standard, Baccarini (1996) has indicated that it cannot be considered an invalid measure. It has been noted *ibid* that complexity affects the project objectives of time, cost and quality, and that it even hinders the clear identification of goals and objectives of major projects. It has also been noted that client's requirements may be more stringent as complexity grows (Tam and Harris, 1996). It is therefore not surprising that complexity is associated with a greater client orientation as that is the means by which the CPOs have any chance of identifying the client's requirements which they can then work towards. Moreover, according to Tam and Harris (*ibid*) the client's supervision of complicated jobs is usually tighter. Perhaps this is attributable to the fact that such jobs are also often the bigger projects.

Although it has been argued that complexity can be accommodated by focusing on integration through coordination, communication and control

(Baccarini, 1996), a view supported by findings from the interviews in which an interviewee remarked that *"the more complex they are the more people have to get their heads together to solve the complexity"*, it was also found in this study that increasing complexity is associated with lower team orientation. This implies that the issues of integrating the project organisation and the tasks are not being addressed adequately for such projects. Perhaps it is also a reflection of the challenges associated with complex projects where mistakes and their attendant conflicts and disputes are more likely to be common.

The data also revealed that as QS's become more influential on projects, the CPO becomes more performance oriented. The role of the QS is to provide *inter alia* a cost management service (Seeley, 1997; Burnside and Westcott, 1999). This role becomes more important as the contract sum increases. It is therefore not surprising that an increase in the importance of the QS's role coincides with greater performance orientation.

Similarly as the client becomes more influential, workforce orientation increases. Workforce orientation is fundamentally about getting the best out of people by developing a culture that makes it easy for everyone to contribute to successfully delivering projects to the benefit of all involved (Constructing Excellence, 2004). As the ultimate beneficiary of any workforce orientation that prevails on a construction project, it is logical to see workforce orientation grow with an increase in the influence of the client. As the main contractor becomes more influential, project orientation suffers. This finding though somewhat surprising, can be related to Hsieh's (1998) point about the development of "islands" or self-centred decision-making units within the CPO each looking out for their own interests. This is a hypothesis that requires further investigation.

Another significant finding from the data is that as cost becomes more important as a project objective, the workforce orientation suffers. This finding reflects the traditional nature of the construction industry where cost is the prime objective (Xiao, 2002) and workforce orientation is characteristically poor as noted by Egan (1998). Alternatively, as the H&S objective becomes more important to the CPO, performance orientation and team orientation both improve.

The number of design variations was found to be significantly and negatively associated with team orientation. As highlighted in Chapter 2, variations may often result in delays and reworking with their attendant costs and programme disruption, as well as reduced labour productivity (Sutrisna and Potts, 2002; Hanna *et al.*, 2002; Moselhi *et al.*, 2005). Moreover, their valuation leads to conflicts and disputes between project participants (Hanna *et al.*, 2002). The finding from the data thus provides empirical evidence of the deterioration in team orientation that can be associated with variations.

With regard to location, there appears to be a crude north-south divide with projects to the north of the UK generally having a lower project orientation than projects in the south, the exceptions being the North-East and the South-West. From the definition of project orientation, this implies that there is less identification with the project, more subcontracting, and less emphasis on waste elimination on projects to the north than projects to the south.

Perhaps one of the most significant findings is the lack of evidence to support the fact that different procurement routes result in different cultural orientations. It has been argued that procurement routes like partnering are associated with a spirit of collaboration, open interaction, trust, commitment, mutual advantage, learning, innovation and productivity (Cook and Hancher, 1990; Crowley and Karim, 1995; Drexler and Larson 2000; Naoum, 2003), in contrast to the traditional culture of antagonism, conflict and disputes. The expectation therefore was that the results would provide some evidence of differences in cultural orientation for different procurement routes. The lack of evidence in this respect gives credence to the suggestion that although partnering contracts are being adopted, the real cultural change it heralds is not embraced (Sullivan, 2006).

6.9 SUMMARY

In this chapter, descriptive statistics, chi-square tests and Freidman's test were utilised to provide a picture of the projects captured in the questionnaire survey. Factor analysis and cluster analysis were also utilised alongside the descriptive statistics to analyse the cultural orientations of the CPOs. Then the Mann-Whitney test, Kruskal-Wallis test, and non-parametric correlation analysis were employed to explore and draw inferences about the relationships between project features and the cultural orientations of CPOs.

The results indicate that the sample is generally reflective of construction projects in the UK. Projects of all kinds, reflecting the range of projects that contractors undertake from simple jobbing projects to very complex mega projects, and procured under different arrangements in all the different regions of the UK are represented in the sample. The Main Contractor was reported as the most influential participant overall. Of great significance was the fact that overall, the performance ethos of CPOs was found to be in the order H&S–quality–cost–time with H&S as the most important and time as the least important. It is argued that this suggests a shift in priorities from what obtains traditionally where cost is considered as the most important objective. Analysis of relationships between these project features revealed strong positive associations between contract price, project duration, average number of workers on site, actual out-turn cost and the actual duration, which are all measures of project size. The 'bigger' the project, the more complex it is likely to be and the greater the number of design variations that are likely to occur. It was also found that the bigger projects are the public sector new work projects within the civil engineering category. Such projects are associated with greater influence of the civil engineer and the QS. Significantly the bigger a project gets, the greater the priority on cost but the lower the emphasis on quality and on H&S.

The application of factor analysis to the dimensions of culture led to the extraction of five principal dimensions of workforce, performance, team, client and project orientation. Based on these five dimensions, it was found that the CPOs can be grouped into five clusters which are significantly different along workforce, team, client and project orientations. This provides confirmation that CPOs do indeed have different cultures. Analyses carried out to assess the differences in cultural orientations associated with the differences in project features revealed evidence that some of the project features are significantly associated with the cultural outcomes. In particular, project size, complexity, the influence of participants like the quantity surveyor, client and the main contractor, the level of importance of cost and H&S, location, and the number of design variations showed evidence of association with some of the dimensions of culture.

It is argued in this chapter that there is still some scope for strengthening the orientations of the CPOs along all the five dimensions of culture. However whether or not it is necessary to devote resources to any effort to improve cultural orientations depends on research demonstrating that such improvements will lead to better performance outcomes. As part of the process of trying to demonstrate this, the following chapter presents the analysis of performance outcomes of the projects surveyed.

CHAPTER 7: PROJECT PERFORMANCE OUTCOMES

7.0 INTRODUCTION

In order to evaluate the impact of cultural orientations on project performance outcomes, it is necessary to assess the performance of construction projects in the UK, where performance is the degree to which the project objectives are achieved. The performance of the construction project was assessed on the basis of the various outcomes pursued by stakeholders including *inter alia* cost, time, quality, health and safety, disputes, and productivity outcomes. Discussions on these various outcomes are presented in this chapter. The chapter thus addresses the second part of the fifth objective of this research which was to assess project organisations, through a UK-wide questionnaire survey, and to establish their levels of performance. It also attempts to address the second of the three research hypotheses which posits that there are significant differences in the performance levels of different projects across the UK.

7.1 STATISTICAL PROCEDURES AND ANALYSES

Here also a variety of statistical procedures were employed in the analyses of the data starting with basic descriptive statistics to the more complex procedures like factor analysis. The descriptive statistics encompassed frequency distributions, measures of central tendency such as means, medians and modes, and measures of dispersion such as the standard deviation. These were employed to provide summary descriptions of the performance levels of the projects.

In some cases where there were two sets of scores to compare from the same subjects (e.g. project contract sum and actual cost), the Wilcoxon signed-rank test was applied as specified in Field (2000). The Wilcoxon signed-rank test is a nonparametric test for two related samples that allows testing for differences between paired scores when the assumptions required by the paired-samples *t* test are not met (SPSS, 2004). The Wilcoxon signed-ranks method tests the null hypothesis that two related medians are the same. This test thus allows the comparison of a single median against a known value or paired medians from the same (or matched) sample (SPSS, 2004).

As in the preceding chapter, tests of correlation were carried out to assess the existence of relationships between the performance measures. In this case also as some of the data to be tested was ordinal, the non-parametric Spearman's correlation coefficient was calculated.

Factor analysis was then carried out to examine the underlying structure or the structure of interrelationships (or correlations) among the performance variables. This analysis yields a set of factors or underlying variables which, when interpreted and understood, describe the data in a parsimonious but more meaningful number of concepts than the original individual variables (Hair *et al.*, 1998). Here also because of the data reduction intention, principal components analysis was used for the extraction of factors. The extracted components were used to compute new variables for subsequent analysis.

Finally, the nonparametric statistical tests of Kruskal-Wallis and Mann-Whitney were used to test for the significance of the differences between the mean ranks of the performance variables for different projects (i.e. whether or not the values of a particular performance variable differ between two or more groups).

7.2 AN EVALUATION OF PERFORMANCE OUTCOMES

In order to obtain an overall picture of the levels of performance of the construction projects captured in the survey, various performance measures were assessed in line with Table 5.2 (refer Chapter 5). Principal among these measures were cost, time, quality, H&S, service, productivity, operative satisfaction, collaborative working, learning, innovation, profitability, and the level of repeat business. These measures were evaluated individually, and the findings are outlined below.

7.2.1 Cost performance (CP)

Cost performance was assessed using a number of measures. Respondents were asked to provide the contract sum as well as the final out-turn cost (ascertained final account). As a first step, it was considered necessary to check for a significant difference between the two variables. The Wilcoxon Signed-Rank test was used. This test was appropriate as there were two sets of data from the same respondents to compare. Tables 7.1 and 7.2 are the outputs obtained from SPSS.

Table 7.1 A comparison of actual cost and contract sum

		N	Mean Rank	Sum of Ranks
Act_cost - Contract price (million)	Negative Ranks	9[a]	30.78	277.00
	Positive Ranks	37[b]	21.73	804.00
	Ties	18[c]		
	Total	64		

a Act_cost < Contract price (million)
b Act_cost > Contract price (million)
c Act_cost = Contract price (million)

Table 7.2 Wilcoxon Signed Ranks Test

	Act_cost - Contract price (million)
Z	-2.879[a]
Asymp. Sig. (2-tailed)	.004

a Based on negative ranks.

The test gives a z-score of -2.879 (based on the negative ranks) which is highly significant with p = 0.004. This result implies that there is strong evidence of a difference between the contract sums and the out-turn costs (final account), and specifically that the out-turn costs are significantly higher than the contract sums.

Cost performance was thus assessed by computing a variable representing the cost overrun based on the difference between the original contract price and the final out-turn price. This difference between the two sums was expressed as a percentage of the original contract sum. This was taken as a measure of the cost performance.

$$\mathrm{CP2} = \frac{(\text{actual cost} - \text{contract sum})}{\text{contract sum}} \times 100\%$$

Where: CP2 = percentage cost performance

From the analysis of the descriptive statistics (Table 7.3), mean cost performance (CP2) is 16.78% over budget. However standard deviation is over 83% indicating a wide variation of cost performance. It ranges from 96.62% under budget to a high of 575.74% over budget. In such scenarios, the median is the best statistic, and in this case, the median is 1.66% over budget.

Table 7.3 Descriptive statistics of cost performance measures

		CP1	CP2	CP3	CP4
N	Valid	64	64	64	64
	Missing	0	0	0	0
Mean		-1.4340	16.7762	4.16	2.44
Std. Error of Mean		1.51458	10.38899	.301	.091
Median		.0095	1.6645	4.00	3.00
Mode		.00	.00	2	3
Std. Deviation		12.11661	83.11192	2.412	.732
Minimum		-96.62	-96.62	1	1
Maximum		2.88	575.74	8	3

Because of the large standard deviation, the data was transformed into categorical data. The data was banded into the categories shown in Table 7.4 (CP3). Associated statistics are shown in Table 7.3. Mean (and median) class is 4 which corresponds with 0.51% - 2.06% over budget, a value consistent with the median of 1.66% over budget obtained earlier.

Table 7.4 Frequency distribution of banded cost performance (CP3)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= -3.64	8	12.5	12.5	12.5
	-3.63 - .00	19	29.7	29.7	42.2
	.01 - .50	1	1.6	1.6	43.8
	.51 - 2.06	7	10.9	10.9	54.7
	2.07 - 5.97	7	10.9	10.9	65.6
	5.98 - 8.89	7	10.9	10.9	76.6
	8.90 - 19.28	8	12.5	12.5	89.1
	19.29+	7	10.9	10.9	100.0
	Total	64	100.0	100.0	

The data was also classified into the three distinct categories of projects that were delivered *under budget*, *on budget*, or *over budget* (CP4). Frequencies for these categories are shown in Table 7.5. Associated statistics are also shown in Table 7.3.

Table 7.5 Frequency distribution of banded cost performance (CP4)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	under budget	9	14.1	14.1	14.1
	on budget	18	28.1	28.1	42.2
	over budget	37	57.8	57.8	100.0
	Total	64	100.0	100.0	

For the projects under analysis, only 42.2% were either on budget or under budget. These values appear to be consistent with other surveys on the cost performance of the construction industry as reported in sources like Kashiwagi *et al*. (2006) which stated that only 45% of clients in the UK indicated that the costs were on target.

It has been argued elsewhere (cf. Tam and Harris, 1996) that such a measure is rather simplistic as it does not take account of any justifiable reasons for cost overruns. Therefore as an alternative measure of cost performance, respondents were also asked to indicate the level of client satisfaction with cost. Satisfaction was rated on a scale of 1 to 5, and descriptive statistics are shown in Table 7.6.

Table 7.6 Descriptive statistics of cost satisfaction measure

		Sat_cost
N	Valid	64
	Missing	0
Mean		4.05
Std. Error of Mean		.103
Median		4.00
Mode		4
Std. Deviation		.825
Minimum		1
Maximum		5

As can be seen from Table 7.6, the mean rating is 4.05 with a standard deviation of 0.825. Both the modal and median ratings are 4 implying satisfied clients on average. It can also be seen from the frequency table (Table 7.7) that on the projects covered by the sample, 79.7% of clients were either satisfied or very satisfied with the cost outcomes whilst the remaining 20.3% were either indifferent about the cost outcomes or were dissatisfied.

Table 7.7 Frequency distribution of cost satisfaction measure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.6	1.6	1.6
	2	1	1.6	1.6	3.1
	3	11	17.2	17.2	20.3
	4	32	50.0	50.0	70.3
	5	19	29.7	29.7	100.0
	Total	64	100.0	100.0	

The difference between these statistics and the previous statistics on cost performance lends credence to the arguments in Tam and Harris (1996), in that it could be interpreted as meaning that many clients were not dissatisfied with cost outcomes because there were justifiable reasons for the cost overruns. Not surprisingly, 94.6% of all respondents on over-budget projects blamed variations (*aka* change orders) for these cost overruns. This is consistent with Jahren and Ashe (1990, in Xiao, 2002) which identified design variations as one of the main causes of budget overruns. 8.1% also attributed the overruns to reworking defective areas and poor project management, whilst 5.4% identified other factors as being responsible for the cost variation.

Indeed, the higher level of satisfaction relative to the on-target projects may also be a reflection of the low level of expectation that clients have of the construction industry (CCF/CBPP, 1999). It has been argued by Johnson and Forrell (1991, in Soetanto, 2002), Oliver (1997) and Soetanto (2002) that in registering (dis)satisfaction, the processing psychology (*'black box'*) considers not just the performance outcomes but also certain antecedent states like expectations. It is therefore reasonable to propose that clients of the construction industry may have such low expectations of the ability of the industry to deliver products within budget that it does not take a lot to satisfy them. If this is the case, then it is an indictment on an industry that has been described in some quarters as "excellent and world class at its best" (Egan, 1998).

7.2.2 Time performance (TP)

Time performance was assessed by asking the respondents to provide the proposed duration as well as the actual duration of the project. This data was treated and analysed in the same way as the cost performance data. A check was first carried out on the existence of a significant difference between the two variables. The Wilcoxon Signed-Ranks test produced the output shown in Tables 7.8 and 7.9

Table 7.8 A comparison of actual duration and planned duration

		N	Mean Rank	Sum of Ranks
Act_dur - Project duration (months)	Negative Ranks	11[a]	18.95	208.50
	Positive Ranks	26[b]	19.02	494.50
	Ties	27[c]		
	Total	64		

a Act_dur < Project duration (months)
b Act_dur > Project duration (months)
c Act_dur = Project duration (months)

Table 7.9 Wilcoxon Signed Ranks Test

	Act_dur - Project duration (months)
Z	-2.162[a]
Asymp. Sig. (2-tailed)	.031

a Based on negative ranks.

A z-score of -2.162 (based on negative ranks) was obtained, and this was significant with a sig. value of $p = 0.031$. This implies that there is some evidence to reject the null hypothesis and conclude that there is a significant difference between the proposed and actual durations, and specifically that the actual durations are longer than the planned duration.

The difference between the proposed and actual durations was computed and expressed as a percentage of the proposed project duration. This was used as a measure of time performance similar to Kog *et al.* (1999). This measure was then transformed into two categorical sets of data by specifying first of all, a number of bands for the data (TP3) and secondly specifying three distinct categories with measures less than 0% classified as *early*, measures at 0% classified as *on time*, and time performance measures over 0% classified as *late* projects (TP4). The descriptive statistics computed for all these time performance measures are presented in Table 7.10. Mean time performance (TP2) is 6.57% over proposed duration with standard deviation of 35.28% indicating a wide variation of time performance. Time performance ranges from -79.81% to 233.33% time overrun. The median, which is the most suitable measure of central tendency, is 0%. When banded, the median class obtained is 2 which corresponds with class -11.10% - 0% (Table 7.11).

Table 7.10 Descriptive statistics of time performance measures

		TP1	TP2	TP3	TP4
N	Valid	64	64	64	64
	Missing	0	0	0	0
Mean		-.0182	6.5727	2.94	2.23
Std. Error of Mean		.85845	4.41038	.200	.091
Median		.0000	.0000	2.00	2.00
Mode		.00	.00	2	2
Std. Deviation		6.86758	35.28307	1.602	.729
Minimum		-47.89	-79.81	1	1
Maximum		21.00	233.33	6	3

Analysis of the statistics on TP4 gives a median of 2 (Table 7.10) corresponding to the category '*on time*'. Therefore most projects were on time. The total of 59.4% (Table 7.12) of all the projects on target (time-wise) compares reasonably with Kashiwagi *et al.*'s (2006) report of 62% of projects on time.

Table 7.11 Frequency distribution of banded time performance (TP3)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= -11.11	8	12.5	12.5	12.5
	-11.10 - .00	30	46.9	46.9	59.4
	.01 - 5.56	5	7.8	7.8	67.2
	5.57 - 12.50	8	12.5	12.5	79.7
	12.51 - 21.43	5	7.8	7.8	87.5
	21.44+	8	12.5	12.5	100.0
	Total	64	100.0	100.0	

Table 7.12 Frequency distribution of banded time performance (TP4)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	early	11	17.2	17.2	17.2
	on time	27	42.2	42.2	59.4
	late	26	40.6	40.6	100.0
	Total	64	100.0	100.0	

Like cost performance, this measure does not take account of any justifiable reasons for overruns. As an alternative measure, respondents were also asked to rate the level of client satisfaction with time (Table 7.13). Mean rating was found to be 4.09 with standard deviation of 0.904. Both modal and median ratings are 4.

Table 7.13 Descriptive statistics of time satisfaction measure

		Sat_time
N	Valid	64
	Missing	0
Mean		4.09
Std. Error of Mean		.113
Median		4.00
Mode		4
Std. Deviation		.904
Minimum		1
Maximum		5

It can be seen from Table 7.14 that 81.2% of clients were either satisfied or very satisfied with the time performance. The same arguments made for the cost performance are also applicable here. Indeed, all respondents (100%) on late projects blamed variations, 34.6% also blamed inclement weather, 11.5% blamed poor project management, and 3.8% blamed problems with labour. Another 15.4% identified other factors as being responsible for the lost time.

Here also the higher level of satisfaction relative to the on-target projects may also be a reflection of the low level of expectation that clients have of the construction industry as argued previously.

Table 7.14 Frequency distribution of time satisfaction measure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.6	1.6	1.6
	2	3	4.7	4.7	6.3
	3	8	12.5	12.5	18.8
	4	29	45.3	45.3	64.1
	5	23	35.9	35.9	100.0
	Total	64	100.0	100.0	

Respondents were also asked to state the amount of liquidated and ascertained damages (LADs) paid on the projects that were late. Surprisingly (or rather not surprisingly), only three of the twenty six (26) late projects had been subjected to LADs.

7.2.3 Quality performance (QP)

Respondents were asked to indicate the extent to which projects were free from defects at handover. As shown in Figure 7.1, only 25.4% were defect-free. A survey of performance reported in Constructing Excellence (2006) provides support for these findings. The survey reported a 77% defect rate, similar to the rate found in this research. Compared with the CCF/CBPP (1999) survey which reported a 90% defect rate in construction projects (including major and minor defects), it appears that there have been some improvements in the quality performance of construction projects.

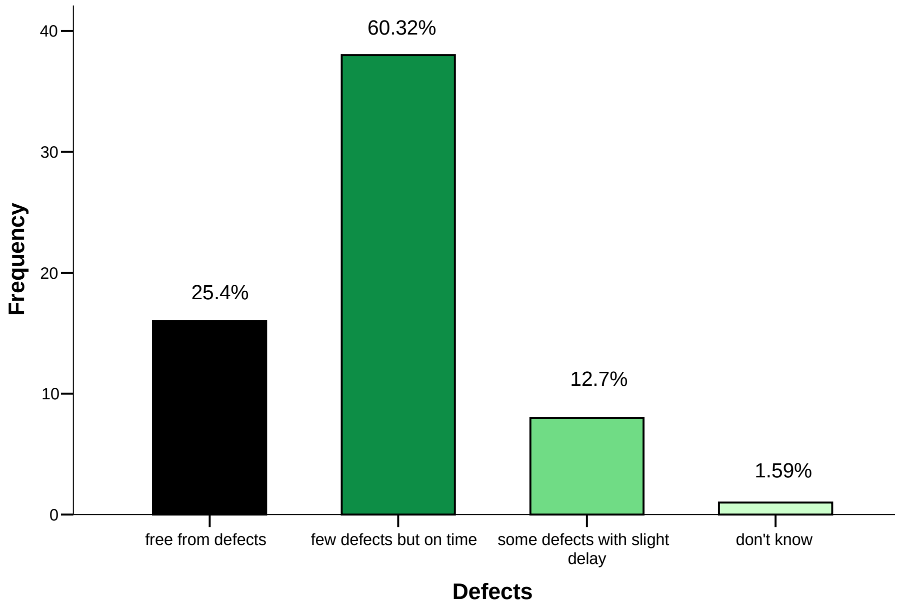

Figure 7.1 Distribution of defects

On the 12.7% of projects where defects led to some delays, the mean delay period was 2.2 weeks with standard deviation of 0.636 (Table 7.15).

Table 7.15 Delay period (weeks)

		Delay
N	Valid	8
	Missing	0
Mean		2.1667
Std. Error of Mean		.22493
Median		2.0834
Mode		2.00
Std. Deviation		.63621
Minimum		1.00
Maximum		3.00

An alternative measure of QP was found by assessing the level of client satisfaction with quality (Table 7.16). Mean rating for client satisfaction was found to be 4.30 with standard deviation 0.683. As can be seen from Table 7.17 below, 87.5% were either satisfied or very satisfied with quality. This seems to be consistent with the initial measure of QP. When this figure is juxtaposed against the 85.7% of projects which were either defect-free or with few defects but handed over on time, one logical interpretation could be that clients of the construction industry will be satisfied with quality as long as there are no significant defects that adversely affect the project handover.

Table 7.16 Descriptive statistics of satisfaction with quality

		Sat_qual
N	Valid	64
	Missing	0
Mean		4.30
Std. Error of Mean		.085
Median		4.00
Mode		4
Std. Deviation		.683
Minimum		3
Maximum		5

Table 7.17 Frequency distribution of satisfaction with quality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	8	12.5	12.5	12.5
	4	29	45.3	45.3	57.8
	5	27	42.2	42.2	100.0
	Total	64	100.0	100.0	

7.2.4 Health and safety (H&S)

Health and Safety (H&S) was assessed using a number of measures comprising accidents reported, near misses reported, fatalities occurring and injuries occurring. The H&S statistics are shown in Table 7.18 below.

Looking at the median values it can be seen that in the UK, for any two typical projects executed, there is likely to be just one reportable accident. This is based on the median value of 0.5 accidents reported.

Table 7.18 Descriptive statistics of health and safety performance

		Acc_rep	Near_misses	Fatalities	Injuries
N	Valid	64	64	64	64
	Missing	0	0	0	0
Mean		1.03	.70	.00	.82
Std. Error of Mean		.198	.190	.000	.158
Median		.50	.00	.00	.00
Mode		0	0	0	0
Std. Deviation		1.583	1.518	.000	1.261
Minimum		0	0	0	0
Maximum		8	9	0	5

To put these statistics into proper context, it is necessary to consider the number of manhours for which these results apply. The nature of the data collected however precluded an accurate calculation of the exact number of manhours. An estimate based on the median project duration, median of the average number of workers on site per day, and an assumption of a 40 hour week, was calculated as shown below:

$$\text{Estimated ave. manhrs} = \text{median}_{(\text{actual duration})} \times 4\text{ wks} \times 5\text{ days} \times 8\text{ hrs} \times \text{class midpt of median}_{(\text{average number of workers on site})}$$
$$= 10 \times 4 \times 5 \times 8 \times 19.5$$
$$= 31{,}200\text{ manhours}$$

This implies that for the 64 cases under consideration, the accident and injury rate was 0.5 per 31,200 manhours (or one accident per 62,400 manhours).

50% of these projects reported no accidents at all, which is comparable with the 51% reported by Constructing Excellence (2006). 62.5% also reported no near misses, whilst 56.3% reported no injuries on projects. These results according to Constructing Excellence (*ibid*) are evidence that health and safety standards are improving.

7.2.5 Client satisfaction with service

Respondents were asked to indicate on a scale of 1 to 5 the level of client satisfaction with the service received. On 85.9% of the projects, the respondents were of the opinion that clients were satisfied or very satisfied with the service they received (Table 7.19). Constructing Excellence (2006) put this figure around 79%. The mean rating for the level of satisfaction was 4.27 with a standard deviation of 0.740 (Table 7.20).

Table 7.19 Frequency distribution of client satisfaction with service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	1.6	1.6	1.6
	3	8	12.5	12.5	14.1
	4	28	43.8	43.8	57.8
	5	27	42.2	42.2	100.0
	Total	64	100.0	100.0	

Table 7.20 Descriptive statistics of client satisfaction with service

		Sat_serv
N	Valid	64
	Missing	0
Mean		4.27
Std. Error of Mean		.092
Median		4.00
Mode		4
Std. Deviation		.740
Minimum		2
Maximum		5

This appears to be consistent with the satisfaction levels reported for cost, time and quality performance, and is marginally better than the satisfaction level reported in Kashiwagi *et al.* (2006).

7.2.6 Satisfaction of operatives

The satisfaction of operatives was assessed in respect of two conditions: satisfaction with conditions and facilities and satisfaction with wages. Respondents were asked to rate the level of employee satisfaction with these two measures. The results are presented below.

7.2.6.1 Site conditions and facilities

On 73.5% of the projects, the respondents were of the opinion that operatives were satisfied or very satisfied with site conditions and facilities (Table 7.21). The mean rating for the level of satisfaction was 4.02 with a standard deviation of 0.745 (Table 7.22).

Table 7.21 Frequency distribution of employee satisfaction with facilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	17	26.6	26.6	26.6
	4	28	43.8	43.8	70.3
	4	1	1.6	1.6	71.9
	5	18	28.1	28.1	100.0
	Total	64	100.0	100.0	

Table 7.22 Descriptive statistics of employee satisfaction

		Sat_fac	Sat_wages
N	Valid	64	64
	Missing	0	0
Mean		4.02	3.73
Std. Error of Mean		.093	.086
Median		4.00	4.00
Mode		4	4
Std. Deviation		.745	.687
Minimum		3	3
Maximum		5	5

7.2.6.2 Wages

On 60.9% of the projects, the respondents were of the opinion that operatives were satisfied or very satisfied with their wages (Table 7.23). The mean rating for the level of satisfaction was 3.73 with a standard deviation of 0.687 (Table 7.22).

Table 7.23 Frequency distribution of employee satisfaction with wages

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	25	39.1	39.1	39.1
	4	4	6.3	6.3	45.3
	4	26	40.6	40.6	85.9
	5	9	14.1	14.1	100.0
	Total	64	100.0	100.0	

7.2.7 Collaborative working

There is widespread recognition in construction that teamwork and collaboration are critical success factors in any project (cf. Dozzi *et al.*, 1996). A number of measures of successful projects associated with these attributes were identified in Dozzi *et al.* (1996), key among which were levels of confrontation and disputes, and the team approach. Data was thus collected in the questionnaire survey to assess these measures of performance.

7.2.7.1 Disputes

For the projects covered in this pilot study, it was apparent from the statistics that disputes were generally on the low side (Table 7.24) with 78.1%, 59.4% and 76.6% of all projects recording no disputes with the client, no disputes with other participants and no unsettled claims at all respectively.

Median values for all three measures are 0. According to Dozzi *et al.* (1996) a low incidence of disputes is a measure of project success.

Table 7.24 Descriptive statistics of disputes

		Disp_client	Disp_others	Claims
N	Valid	64	64	64
	Missing	0	0	0
Mean		.51	.54	.19
Std. Error of Mean		.182	.105	.061
Median		.00	.00	.00
Mode		0	0	0
Std. Deviation		1.457	.842	.487
Minimum		0	0	0
Maximum		10	3	3

7.2.7.2 Overall satisfaction with collaboration and harmony between participants

A good relationship between participants is considered an important measure of performance (Dozzi *et al.*, 1996). On 68.7% of the projects, the respondents were of the opinion that project management was either satisfied or very satisfied with the level of collaboration and harmony between the participants on the construction project (Table 7.25). The mean rating for the level of satisfaction was 3.95 with a standard deviation of 0.844 (Table 7.26).

Table 7.25 Frequency distribution of satisfaction with harmony

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	3.1	3.1	3.1
	3	18	28.1	28.1	31.3
	4	25	39.1	39.1	70.3
	5	19	29.7	29.7	100.0
	Total	64	100.0	100.0	

Table 7.26 Descriptive statistics of satisfaction with harmony

		Sat_harm
N	Valid	64
	Missing	0
Mean		3.95
Std. Error of Mean		.105
Median		4.00
Mode		4
Std. Deviation		.844
Minimum		2
Maximum		5

Generally therefore, the level of harmony and collaboration on the construction projects was satisfactory.

7.2.8 Productivity

It is universally accepted that productivity is the main key to the cost-effectiveness of construction projects (Chan *et al.*, 2002; Bassioni *et al.*, 2004) and is therefore an important measure of success. It is a measure of the extent to which available resources (in particular labour) are utilised efficiently in the delivery of construction projects (Olomolaiye *et al.*, 1998; Chan *et al.*, 2002). The assessment of productivity thus focused on two measures; the level of labour productivity and the level of absenteeism.

7.2.8.1 Level of labour productivity

Respondents were asked to rate the overall level of labour productivity on a scale of 1 to 5. It has been noted in Chan *et al.* (2002) that in research, productivity is usually assessed on a ranked basis. Mean rating was 3.68 with standard deviation of 0.677 (Table 7.27) indicating a high level of productivity overall. What is interesting is that as many as 39.1% considered labour on their projects to be of average productivity, or even unproductive (Table 7.28).

Table 7.27 Descriptive statistics of productivity

		Prod
N	Valid	64
	Missing	0
Mean		3.68
Std. Error of Mean		.085
Median		4.00
Mode		4
Std. Deviation		.677
Minimum		2
Maximum		5

Table 7.28 Frequency distribution of productivity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	1.6	1.6	1.6
	3	24	37.5	37.5	39.1
	4	5	7.8	7.8	46.9
	4	27	42.2	42.2	89.1
	5	7	10.9	10.9	100.0
	Total	64	100.0	100.0	

7.2.8.2 Absenteeism

Another measure of productivity that was assessed was the level of absenteeism on construction projects. The median was found to be 2 (Table 7.29), corresponding to the class 'less than 20 manhours' (Figure 7.2). To put this into context, it should be recalled that the estimated number of manhours per project for the 64 projects is 31200 manhours.

Table 7.29 Descriptive statistics of absenteeism

		Absent
N	Valid	57
	Missing	7
Mean		2.51
Std. Error of Mean		.128
Median		2.00
Mode		2
Std. Deviation		.966
Minimum		1
Maximum		4

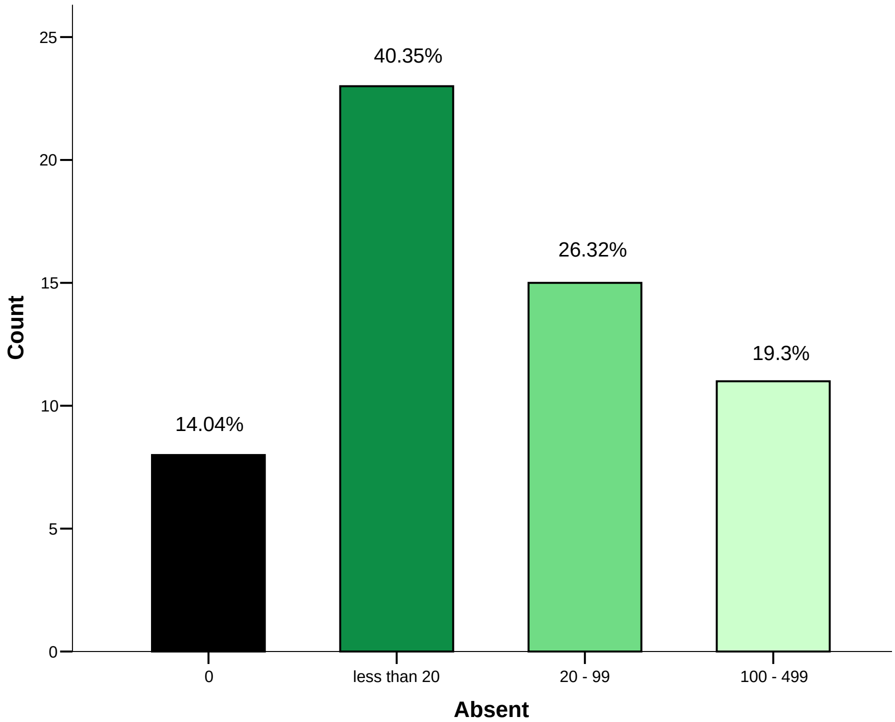

Figure 7.2 Frequency distribution of absenteeism

7.2.9 Other performance measures

Along with the main measures of performance discussed above, a number of other measures of project success were assessed including the degree of learning and innovation that occurred on the project, the level of satisfaction with project profitability, and the amount of repeat business. The results of the data analysis in respect of these measures are presented below.

7.2.9.1 Learning and innovation

Respondents were asked to indicate the level of learning and innovation on this project relative to other projects they had been involved with. Their responses, summarised in the output below, appears to suggest that the level of learning and innovation on these projects was rather moderate (Table 7.30).

Mean ratings for learning and innovation were respectively 3.02 and 2.76 with standard deviations of 0.845 and 0.847 respectively.

Table 7.30 Descriptive statistics of learning and innovation

		Learn	Innov
N	Valid	64	64
	Missing	0	0
Mean		3.02	2.76
Std. Error of Mean		.106	.106
Median		3.00	2.76
Mode		3	3
Std. Deviation		.845	.847
Minimum		1	1
Maximum		5	5

7.2.9.2 Satisfaction with profitability

The mean level of satisfaction with project profitability was found to be 3.46 with standard deviation of 0.881 (Table 7.31). This implies that on average, participants were neither satisfied nor dissatisfied with profitability. Only about 45% were satisfied or very satisfied with the level of profitability (Table 7.32).

Table 7.31 Descriptive statistics of satisfaction with profitability

		Sat_prof
N	Valid	64
	Missing	0
Mean		3.46
Std. Error of Mean		.110
Median		3.46
Mode		4
Std. Deviation		.881
Minimum		1
Maximum		5

Table 7.32 Frequency distribution of project profitability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	4.7	4.7	4.7
	2	4	6.3	6.3	10.9
	3	16	25.0	25.0	35.9
	3	12	18.8	18.8	54.7
	4	24	37.5	37.5	92.2
	5	5	7.8	7.8	100.0
	Total	64	100.0	100.0	

7.2.9.3 Repeat business

A key measure of performance and project success according to Dozzi *et al*. (1996) is repeat business. It is an indication of the level of trust between the client and the contractor. Respondents where thus asked to indicate whether or not they had undertaken any new work for the client since the completion of the project.

54% had subsequent to the completion of this project undertaken other projects for the same client. Given that clients' willingness to select the same contractor for future work is directly influenced by their satisfaction with products and services provided (Maloney, 2003), then arguably this implies that at least 54% of clients in this study were satisfied with their previous performance, and this provides additional support for the validity of the findings in respect of the performance measures like H&S, quality, cost and time performance.

7.3 IDENTIFYING THE PRINCIPAL PERFORMANCE MEASURES

In total, 21 measures of performance were assessed in this research. In order to reduce the number of variables to facilitate subsequent analyses, and also to test the factor structure of the 21 performance measures factor analysis was undertaken. It was also an opportunity to assess the convergent and discriminant validity of the measures of performance. Principal components was adopted as the method of extraction.

To test the suitability of the data for the factor analysis, the Kaiser-Meyer-Olkin measure of sampling adequacy (MSA) and Bartlett test of sphericity were obtained (Table 7.33). The MSA obtained was 0.626 greater than the suggested minimum of 0.60 (UCLA, 2006). The Bartlett test also produced a significant result ($p < .000$), indicating that the data is suitable for factor analysis.

Table 7.33 KMO and Bartlett's Test results

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.626
Bartlett's Test of Sphericity	Approx. Chi-Square	465.461
	Df	210
	Sig.	.000

Six components were initially extracted accounting for 65.7% of the total variance in the 21 performance measures (Table 2, Appendix M). The extraction of the six components was based on the Kaiser criterion which specifies the extraction of all factors with eigen values ≥1 (Field, 2000). The scree plot produced (Figure 7.3) with the thunderbolt marking the point of inflexion, however only provides support for extraction of four components.

Like the dimensions of culture, the aim here was to achieve the most representative and parsimonious set of factors possible (Hair *et al.*, 1998). Therefore the four component solution was accepted and the analysis was re-run extracting four components. These four components extracted account for 53.6% of the total variance in the 21 performance measures (Table 7.34).

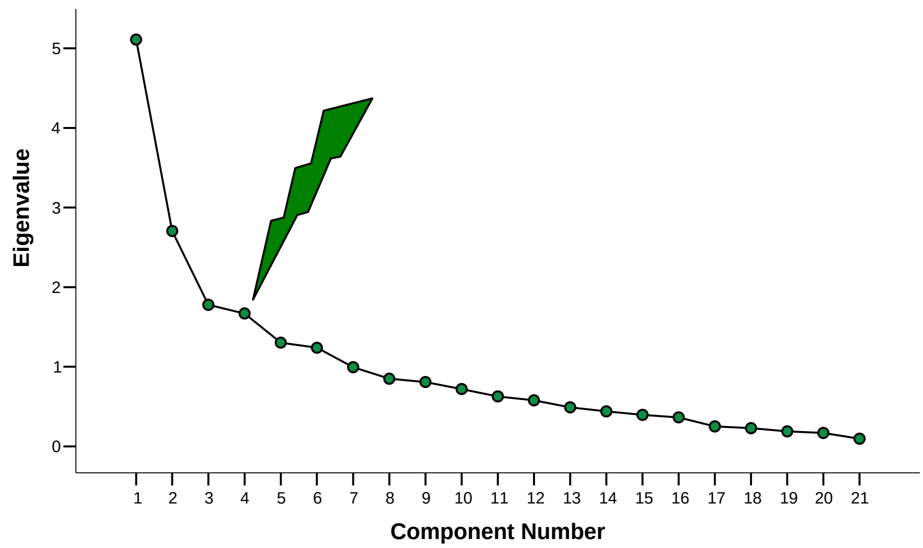

Figure 7.3 Scree plot for factor extraction

Table 7.34 Total variance explained by factors extracted

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.110	24.332	24.332	5.110	24.332	24.332	4.163	19.824	19.824
2	2.705	12.879	37.211	2.705	12.879	37.211	3.246	15.457	35.281
3	1.778	8.466	45.677	1.778	8.466	45.677	1.996	9.505	44.787
4	1.669	7.946	53.623	1.669	7.946	53.623	1.856	8.836	53.623
5	1.303	6.204	59.827						
6	1.239	5.898	65.726						
7	.994	4.735	70.461						
8	.849	4.044	74.505						
9	.809	3.850	78.355						
10	.720	3.427	81.782						
11	.627	2.988	84.770						
12	.578	2.753	87.523						
13	.490	2.335	89.858						
14	.439	2.090	91.948						
15	.396	1.886	93.834						
16	.364	1.734	95.568						
17	.250	1.191	96.759						
18	.228	1.088	97.847						
19	.188	.893	98.740						
20	.168	.802	99.542						
21	.096	.458	100.000						

Extraction Method: Principal Component Analysis.

In order to improve the interpretability of factors, varimax rotation was performed on the extracted component matrix to maximise the loading of each variable on one of the extracted factors whilst minimising its loading on all the other factors (Field, 2000). The rotated component matrix that was obtained after the varimax rotation is displayed below (Table 7.35). The matrix shows the rotated component loadings with loadings less than 0.4 suppressed for clarity.

New variables for these four extracted components were computed using the Anderson-Rubin method (SPSS, 2004) for subsequent analyses.

Table 7.35 Rotated Component Matrix

	Component			
	1	2	3	4
Sat_serv	.828			
Sat_qual	.797			
Sat_harm	.707			
Sat_cost	.680			
Sat_prof	.661			
Sat_time	.592			
Sat_fac	.549			
Acc_rep		.737		
Injuries		.701		
Near_misses		.655		
Absent		.609		
Defects		.581		
Sat_wages	.409	-.448		
Disp_others				
Innov			.753	
Learn			.679	
Prod			.594	
Disp_client				
Time Performance (%)				.862
Claims	-.458			.625
Cost Performance (%)				.522

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Labelling these new components required an examination of the patterns of component loadings for the variables including their signs (Hair *et al*., 1998). Variables with higher loadings were invariably given more weight.

7.3.1 Satisfaction of participants

With the exception of *claims*, all other variables on component one were positive indicating that they all vary together. The negative sign of the variable *claims* indicates that it varies negatively with the other variables that make up the component, and the component itself. As can be seen from Table 7.35, all the higher loadings relate to satisfaction. Indeed, with the exception of *claims*, all the other variables under this component are measures of satisfaction like client satisfaction with *service*, *quality*, *cost* and *time*, management satisfaction with *harmony* and *profitability*, and operative satisfaction with *conditions* and *wages*. This component was therefore labelled *participant satisfaction*. The positive associations between the satisfaction variables is a sign of the inter-relatedness of the satisfaction levels of project participants. There is support in the construction management literature for this assertion. Dozzi *et al.* (1996) for instance argued that if a project is profitable for the contractor, there is a greater chance of the client being satisfied.

It is very common to find this measure of participant satisfaction (or similar) in the literature on performance measures (cf. Chan *et al.*, 2002; Leung *et al.*, 2004) and in some studies of culture (cf. Zuo and Zillante, 2006). Satisfaction is defined in Chan *et al.* (2002) as the level of 'happiness' of people affected by the project including key project participants. It is an attribute of success, which is both dependent on performance and personal standards or expectations (Liu and Walker, 1998; Cox *et al*., 2002). Satisfaction, described in Lui and Walker (1998) as an aptitude (an effect or emotion), is thus a subjective assessment of performance. In this research it encompasses client satisfaction with *service*, *quality*, *cost* and *time*, management satisfaction with *harmony* and *profitability*, and operative satisfaction with *conditions* and *wages*, as well as the absence of *claims*.

Going by the evidence presented so far, it appears reasonable to suggest that participant satisfaction across the construction industry is generally high.

7.3.2 H&S and quality outcomes

With the exception of *satisfaction with wages*, all other variables on component two were positive indicating that they all vary together. As can be seen from Table 7.35, all the higher loadings relate to *accidents reported*, *injuries occuring*, *near misses reported*, *extent of defects*, and the *level of absenteeism*. This component was therefore labelled *H&S and quality outcomes*. Increases in this measure imply worsening performance. The negative relationship between this measure and *satisfaction with wages* indicates that as H&S standards decline, satisfaction with wages also declines, absenteeism grows, and quality levels decline.

It has been reported in the literature (cf. Warrack and Sinha, 1999; Griffith, 2000; Cooper and Phillips, 1995) that H&S and quality are closely associated. Warrack and Sinha (1999) for instance argue that integration of H&S and quality is essential in the development of improvement strategies and describing them as "two sides of the same coin". This is confirmation of the validity of the factor extraction.

H&S and quality outcomes represent important measures of project performance. Indeed in this research, H&S and quality were identified by respondents as the first and second most important project objectives respectively.

7.3.3 Innovation and learning

All the variables on component three were positive indicating that they all vary together. As can be seen from Table 7.35, the variables loading on this component were the measures of *innovation*, *learning*, and *productivity*. As all these variables are positively correlated with component three, it implies that higher levels of innovation are associated with higher levels of learning and higher levels of productivity. Component three was therefore labelled *innovation and learning*. Performance measures associated with the degree of innovation and learning are emerging within the construction project context as some of the 'soft' but very relevant measures of performance as acknowledged for instance by Bassioni *et al.* (2004). An example of the assessment of learning in construction, albeit in an organisational context, is provided by Kululanga *et al.* (2001).

Innovation and learning as a measure of performance, is commonly found in the main performance measurement frameworks like the Balanced Scorecard (Kaplan and Norton, 1996) and the EFQM Excellence Model reviewed in Mbugua (2000) and Bassioni *et al.* (2004). This provides some validation for the factor extraction.

From the descriptive statistics, it can be suggested that the level of innovation and learning in construction is generally not high. This confirms research findings such as those of Riley and Clare-Brown (2001) which showed that there were significantly more innovative values in production and process manufacturing companies than in construction. It also supports the view that collective learning is lost once a project is completed and the project organisation disbands (Ibert, 2004).

7.3.4 Time and cost outcomes

All the variables on component four were positive indicating that they all vary together. As can be seen from Table 7.35, the variables loading on this component were the measures of *time performance*, *claims*, and *cost performance*. As all these variables are positively correlated with component four, it implies that as time performance declines, claims increase and cost performance declines as well. Component four was therefore labelled *time and cost performance*. Increases in this measure imply worsening performance. The packaging of time, claims and cost together in one performance measure is a logical outcome bearing in mind the finding that most cost and time overruns were due to variations, the valuation of which is often associated with disputes and claims.

From the descriptive statistics, it can be suggested that the time and cost performance levels of construction projects in the UK is generally inadequate or even poor.

7.4 EXAMINING PERFORMANCE DIFFERENCES ACROSS PROJECTS

In order to assess whether or not significant differences in performance levels exist across construction projects in the UK, the Kruskal-Wallis test, Mann-Whitney test and Spearman's correlation test were applied to the performance measures and contextual variables. The Kruskal-Wallis and Mann-Whitney tests were applied where the variables involved were nominal, and Spearman's correlation where the variables involved were ordinal or scale. Each of the four principal performance measures was tested and the results are presented in Appendix N. Apart from these four principal measures of performance, an overall project performance index was also developed and assessed, similar to Ogbonna and Harris (2000) and Xiao (2002). This overall project performance index brought together all four aspects of project performance in an attempt to give a holistic view of project performance based on a single aggregated performance indicator.

In this process of aggregation to form an overall performance index, equal weighting was applied to all the four performance measures (25% each). This was because as argued in Xiao (2002), all aspects of performance need to be considered, and the achievement of one aspect of performance should not be at the expense of another. Moreover, Babbie (1990) has also indicated that unless there is a sound basis for differential weighting, equal weighting should be applied. Overall performance was thus taken as the summated mean and calculated as follows:

$$\mathrm{OP} = \frac{1}{4} \times \left(\mathrm{PS} - \mathrm{HQ} + \mathrm{IL} - \mathrm{TC}\right)$$

Where:

OP is Overall performance

PS is Participant satisfaction

HQ is Health and safety and quality

IL is Innovation and learning

TC is Time and cost

All these measures of performance were assessed and the results are shown in Tables 1, 2 and 3 (Appendix N). From these tables it can be seen that with the exception of the overall performance index, all the other performance outcomes vary with the characteristics of the project.

Satisfaction of participants is significantly correlated with the level of importance of H&S on the project (ρ = .268, p = .043). Recalling that the manner in which priorities were ranked with 1 representing most important (refer Chapter 6), this result can be interpreted as meaning that as the level of priority of H&S increases, the satisfaction levels of project participants declines. Relating this with the negative association between priority of H&S and priority of cost established in Chapter 6, it can be inferred that an increase in the importance of H&S which corresponds with a decline in the priority of cost, is associated with a decline in participant satisfaction. This outcome is somewhat surprising as it appears to suggest simply that project participants are more satisfied on projects where there is less emphasis on H&S, but more emphasis on cost.

H&S and quality outcomes vary significantly with whether a project is new work, refurbishment, redevelopment or demolition (χ^2 = 8.351, p = .039). As can be seen from Figure 7.4, demolition projects are by far the worst performers in relation to H&S and quality. When classified only in terms of whether the project is new work or repair and maintenance (R&M), there is also a significant difference in H&S and quality outcomes (z = -2.016, p = .044) with performance significantly better for the R&M than for the new work as shown in Table 3 of Appendix N (ρ = -.291, p = .042). The H&S and quality outcome also varies significantly with complexity (ρ = .310, p = .019), contract price (ρ = .617, p < .000), project duration (ρ = .605, p < .000), influence of the QS (ρ = -.320, p = .027), influence of client (ρ = .281, p = .046), priority of time (ρ = .520, p < .000), priority of quality (ρ = -.306, p = .021), and the number of variations (ρ = .304, p = .022).

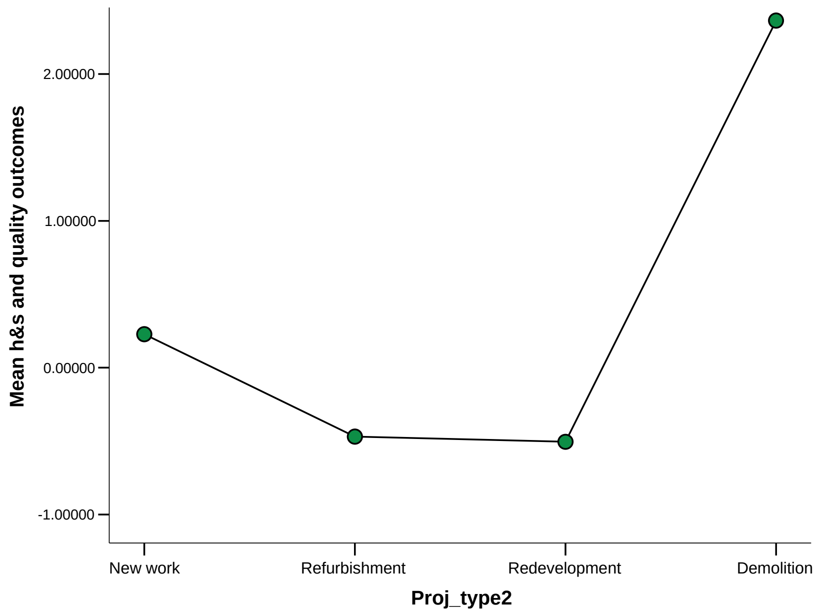

Figure 7.4 Mean H&S and quality outcomes for different project types

From these results it can be inferred that as the complexity and scale (as measured by contract sum and duration) of a construction project grows, and the level of influence of the client increases, H&S and quality declines. Likewise as the priority on quality increases and there are more variations, H&S and quality outcomes suffer. However, H&S and quality outcomes do improve significantly with increases in the level of influence of the QS and the level of priority on time.

Innovation and learning varies significantly with whether a project is housing or non-housing (z = -2.099, p = .036), with more innovation and learning on non-housing projects as revealed by the correlation matrix (ρ = .313, p = .034). It also varies positively with complexity (ρ = .457, p < .000). This result can be interpreted as meaning that the more complex a construction project is, the greater the level of innovation and learning that project participants realise.

Given that the more complex projects and non-housing projects tend to be the bigger projects (refer Chapter 6), it can be inferred that greater levels of innovation and learning are likely to occur on such projects.

The analysis also revealed evidence of a significant difference in time and cost outcomes between projects that are new work and R&M projects ($z = -1.974$, $p = .048$), and as shown in Table 3 (Appendix N) specifically that new work has better time and cost outcomes than R&M projects ($\rho = .285$, $p = .047$).

The evidence from the above analyses clearly indicates that performance levels across projects in the sample, in relation to the various measures assessed in this research, vary from project to project. What remains to be seen is whether such differences are associated with the cultural differences established in Chapter 6.

7.5 SUMMARY

In order to provide a basis for the evaluation of the impact of cultural orientations on project performance outcomes, there was a need to assess the performance of construction projects in the UK. A variety of performance measures including *inter alia* cost, time, quality, health and safety, disputes, and productivity outcomes were thus assessed in this chapter.

Generally, the performance levels found in this research were consistent with other reports and surveys carried out (cf. CCF/CBPP, 1999; Constructing Excellence, 2006; Kashiwagi *et al.*, 2006) with the evidence from the projects captured by the survey suggesting that there have been some improvements in the overall performance levels. Several measures of performance were assessed in this research. However, the application of principal component factor analysis led to the extraction of four principal measures of performance *viz*; *satisfaction of participants*, *H&S and quality*, *innovation and learning*, and *time and cost outcomes*. When analysed across the project characteristics, it was found that whilst overall performance (the aggregation of the four performance measures) did not vary significantly for different project types, satisfaction of participants, H&S and quality, innovation and learning, and time and cost outcomes did vary significantly from project to project. In particular, it was found that H&S and quality outcomes vary the most with project characteristics (Table 3, Appendix N).

The chapter has thus addressed the second part of the fifth objective of this research which was to establish the levels of performance of construction projects in the sample. It has also been demonstrated in response to the second research hypothesis, that there are statistically significant differences in performance levels across construction projects within the sample.

Having established clear differences in cultural orientation and performance levels of construction projects, the next phase of this research focuses on the examination of the data for evidence of relationships between cultural orientations and performance outcomes. The next chapter addresses this aspect of the research.

CHAPTER 8: THE CULTURE OF THE CONSTRUCTION PROJECT ORGANISATION AND PROJECT PERFORMANCE

8.0 INTRODUCTION

The final two objectives of this research are to explore the possible relationships between each specific cultural attribute and the performance of the project organisations, and to develop models that relate organisational culture with performance. It has been established in the last two chapters that different cultures exist within different project organisations. It has also been established that performance levels vary from project to project. Therefore to address the last two objectives of this research it is necessary to explore the extent to which the differences in cultural orientation are associated with the differences in performance outcomes. This chapter therefore explores the potential relationships between the operating cultures within the CPOs and the project performance outcomes to determine whether or not any significant association exists. Models of the relationships are developed and presented in this chapter to help identify best practice cultural orientations.

8.1 THE RESEARCH HYPOTHESIS AND STATISTICAL ANALYSIS

The main aim of this research is to establish empirically whether or not the culture within a CPO has an impact on its performance, and to investigate the nature of any relationship(s) that exist. To help achieve this, a hypothesis was advanced in Chapter 4 as follows:

H_3: There is a significant relationship between the culture of the CPO and construction project performance.

In order for this hypothesis to be actually operationalised and tested, it can be interpreted as meaning that variations in the orientations of CPOs in relation to the five dimensions of workforce, performance, team, client and project orientation, are likely to be associated with differences in project performance outcomes. The task of testing the hypothesis is thus simplified to an examination of the data for evidence of significant associations between the dimensions of culture and the measures of performance.

To facilitate this analysis, two widely used statistical techniques in empirical culture research were employed; correlation and multiple regression (cf. Denison and Mishra, 1995; Cooke and Szumal, 2000; Ogbonna and Harris, 2000; Hofstede, 2001).

8.1.1 Correlation

As in the last two chapters, analysis of the correlations between the variables was carried out to assess the existence of associations between the dimensions of culture and the performance measures. In this case, Pearson's product moment correlation coefficients represented by *r*, was computed. This statistic is appropriate when both variables are measured at an interval level (Trochim, 2006). The equation to compute the correlation coefficient, *r*, is given by Field (2000) as:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{(n-1)S_x S_y}$$

Where:

x and y are any pair of independent variables whose level of correlation is being sought

$\bar{x}$ and $\bar{y}$ are the means of x and y respectively

S_x and S_y are the standard deviations of x and y respectively.

Correlation analysis is a very common statistical tool in culture-in-construction research. Some examples of research that have utilised this technique include Liu (1999), Cheung *et al.* (2003), Phua and Rowlinson (2004) and Chan and Chan (2005). This measure of association has also been noted as an important step towards the development of the regression model(s) (Hair *et al.*, 1998).

8.1.2 Multiple regression

Multiple regression is essentially the derivation of a regression model with two or more independent variables. It is a method for studying the effects and the magnitude of the effects of more than one independent variable on one dependent variable using correlation and regression (Kerlinger and Lee, 2000). It leads to the derivation of an equation in which each independent (predictor) variable has its own coefficient and the dependent (outcome) variable is predicted from a combination of all the variables multiplied by their corresponding coefficients plus a residual term (Field, 2000). A generic equation of this multiple regression model is given *ibid* as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon_i$$

Where:

Y is the outcome variable

β_1 is the coefficient of the first predictor X_1

β_2 is the coefficient of the second predictor X_2

β_n is the coefficient of the nth predictor X_n

ε_i is the difference between the predicted and observed value of Y for the ith subject.

According to Hair *et al.* (1998), the coefficients are weights which effectively denote the relative contribution of the predictor variables to the overall prediction, and facilitate interpretation as to the influence of each variable in making the prediction. As aptly stated in Kerlinger and Lee (2000), the results of the calculations indicate how 'good' the prediction is and approximately how much of the variance of the outcome is accounted for by the 'best' linear combination of the predictors. This is what makes the multiple regression model particularly appropriate in this research which seeks to examine the influence of various dimensions of culture (independent variables) on each project performance outcome (dependent variable).

8.1.2.1 Methods of variable selection in multiple regression

There are several methods for deciding which independent variables to use in the regression model and how to enter these variables into the model. Field (2000) identified three principal methods as hierarchical, forced entry, and stepwise methods.

Hierarchical regression relies on the identification of predictors based on past research. These known predictors are then entered into the regression model in order of their importance, after which the previously unidentified predictors are entered (Field, 2000). In this research, the absence of strong empirical evidence of important predictors from the literature on cultural orientations and performance precluded the use of this method of regression.

With forced entry, all the predictors are forced into the model simultaneously. As noted in Field (2000), this method also relies on the existence of sound theoretical bases for inclusion of all the chosen variables, a requirement which cannot be satisfied in this research.

The most viable option for this research is thus the stepwise method. In the stepwise method, the decisions about what variables to enter into the model and the order in which they are entered are based entirely on a mathematical criterion (Field, 2000). This approach according to Xiao (2002) yields a final equation that is simple yet powerful enough to reveal any significant relationships. Predictors not in the model are evaluated for entry one at a time, with the best predictor being entered into the model, and those already in the equation are evaluated for removal one at a time with the removal of the most insignificant predictor, until no more predictors are eligible for entry or removal (Field, 2000; Xiao, 2002). The criterion for entry of a predictor is that the significance of the F test must be ≤ 0.05, and the criterion for removal is that the significance of the F test must be ≥ 0.10.

8.1.2.2 Assumptions of regression

There are a number of key assumptions associated with the multiple regression procedure. These assumptions must be met for the regression analysis to guarantee a model in which the actual errors in prediction are as a result of the real absence of a relationship among the variables and not caused by some characteristic of the data not accommodated by the regression procedure (Hair *et al.*, 1998). These assumptions are given *ibid* as follows:

- Linearity of the phenomenon measured
- Constant variance of the error terms
- Independence of the error terms
- Normality of the error term distribution

Hair *et al.* (1998) have indicated that the principal measure of prediction errors is the *residual*, which is the difference between the observed and predicted values for the outcome variable. Analysis of the residuals is thus the principal means of identifying violations of the assumptions. According to Hair *et al*. (*ibid*), plots of the standardised residuals versus predictor and outcome variables is the basic method of identifying assumption violations.

Specific patterns of these residuals indicate violations of particular assumptions. These assumptions are discussed in more detail below.

Linearity

Multiple regression assumes a linear relationship between the outcome variable and the predictor variables. One approach for testing this assumption is to plot the outcome against the predictor variables, and the data points should cluster around a straight line if the assumptions are met (Xiao, 2002). Linearity can also be assessed from an examination of residual plots which must show a random distribution of data points. Hair *et al.* (1998) and Field (2000) provide a number of residual plots which show non-linear patterns of residuals. Where such non-linear relationships exist, alternative regression methods such as the introduction of polynomial terms must be considered.

Constant variance

Heteroscedasticity, or the presence of unequal variance has been described as one of the commonest assumption violations. It is diagnosed also by plots of studentised residuals against the predicted outcome values. A consistent pattern (triangle or diamond-shaped) in such a plot is evidence that the variance is not constant (Hair *et al.*, 1998). Alternatively, the Levene test for homogeneity of variance can be produced by SPSS (SPSS, 2004). Significant values indicate a departure from constant variance.

Independence

It is expected that the residual terms for any two cases should be uncorrelated (i.e. independent). Autocorrelation is said to exist where residual terms are not independent (Field, 2000). The Durbin-Watson test for serial correlation of the residuals (SPSS, 2004), can be used to evaluate this assumption. The test statistic can vary between 0 and 4 with the value of 2 meaning that the residuals are uncorrelated or independent (Field, 2000). As a general rule of thumb, the closer the value is to 2, the better.

Normality

A fundamental assumption of multiple regression, and what Hair *et al.* (1998) described as the most frequently violated assumption, is the assumption of normality of the predictor and outcome variables. The simplest diagnostic tool for the set of predictors in the equation is the histogram of residuals which by visual inspection should be bell-shaped, approximating the normal distribution. A better method is the use of the normal probability plot (P-P plot) which compares the standardised residuals with a normal distribution which is represented by a straight diagonal line. If the distribution is normal, then the residual line must closely follow this diagonal line (Hair *et al.*, 1998).

As indicated in Field (2000), it is only when all these assumptions are met that the model can be accurately applied to the population. All the assumptions were thus tested as each multiple regression model was generated.

Multiple regression is a widely used multivariate technique in construction management research. For example, Cheung *et al.* (2003) used this technique to relate contract elements to partnering attributes; Phua and Rowlinson (2004) used this approach to determine the extent to which intra- and inter-organisational cooperation was affected by a number of cultural attributes; and leader behaviours were regressed on employee work outcomes in Chan and Chan (2005) revealing *inter alia* that all factors of transformational leadership (except idealised behaviours) and contingent reward and management by exception were positively related to all facets of employee work outcomes. All these researches have sought to examine and model the relationships between predictor and outcome variables, an aim which clearly resonates with the aim of this research.

8.2 THE CULTURE – PERFORMANCE CORRELATION

Correlations measure how variables or rank orders are related. The bivariate correlations procedure in SPSS was used to compute Pearson's correlation coefficients with their significance levels. Pearson's correlation coefficient is a measure of linear association (Field, 2000). It is useful for determining the strength and direction of the association between two variables which could be positively related, not related at all or negatively related (*ibid*).

Before calculating the correlation coefficients, the data was screened for outliers (which can cause misleading results) and evidence of linear relationships by plotting scatterplots of the various variables. A sample of these scatterplots are shown in Appendix O. Although in some instances outliers were evident (e.g. Figure 2, Appendix O), no logical reason could be adduced to warrant exclusion, and therefore all the cases were included in the analysis. Beyond the outliers, there was no evidence in the distribution of the data points to suggest relationships other than linear between the variables. This implies that tests of linear association between the variables are appropriate. Table 8.1 shows the correlation matrix produced in this analysis. It can be seen that with the exception of time and cost outcomes, there is evidence to show that all the other performance outcomes, including overall performance are related to one or other dimension of culture.

Satisfaction of participants is significantly and positively associated with the workforce orientation ($r = .299$, $p = .024$) and the team orientation ($r = .351$, $p = .007$). This implies that as workforce orientation on a project rises, the satisfaction of project participants also rises. Likewise as the team orientation on the project rises, so does the satisfaction of participants. These same relationships were found in Zuo and Zillante (2006) which reported significant correlations between the dimensions integration, cooperation and people orientation and project team satisfaction.

Table 8.1 Pearson's product-moment correlation matrix of cultural dimensions and performance outcomes

		workforce orientation	performance orientation	team orientation	client orientation	project orientation	satisfaction of participants	h&s and quality outcomes	innovation and learning	time and cost outcomes	overall performance
workforce orientation	Pearson Correlation	1	.000	.000	.000	.000	.299*	.014	.255	-.018	.279*
	Sig. (2-tailed)	1	1.000	1.000	1.000	1.000	.024	.919	.056	.892	.035
	N	64	64	64	64	64	57	57	57	57	57
performance orientation	Pearson Correlation	.000	1	.000	.000	.000	.174	-.003	.161	.064	.137
	Sig. (2-tailed)	1.000		1.000	1.000	1.000	.196	.980	.231	.635	.309
	N	64	64	64	64	64	57	57	57	57	57
team orientation	Pearson Correlation	.000	.000	1	.000	.000	.351**	-.280*	-.262*	.078	.146
	Sig. (2-tailed)	1.000	1.000		1.000	1.000	.007	.035	.049	.566	.280
	N	64	64	64	64	64	57	57	57	57	57
client orientation	Pearson Correlation	.000	.000	.000	1	.000	.148	.204	.206	-.189	.169
	Sig. (2-tailed)	1.000	1.000	1.000		1.000	.271	.127	.124	.160	.208
	N	64	64	64	64	64	57	57	57	57	57
project orientation	Pearson Correlation	.000	.000	.000	.000	1	.073	-.375**	.142	-.175	.382**
	Sig. (2-tailed)	1.000	1.000	1.000	1.000		.592	.004	.293	.192	.003
	N	64	64	64	64	64	57	57	57	57	57
satisfaction of participants	Pearson Correlation	.299*	.174	.351**	.148	.073	1	.000	.000	.000	.500**
	Sig. (2-tailed)	.024	.196	.007	.271	.592		1.000	1.000	1.000	.000
	N	57	57	57	57	57	57	57	57	57	57
h&s and quality outcomes	Pearson Correlation	.014	-.003	-.280*	.204	-.375**	.000	1	.000	.000	-.500**
	Sig. (2-tailed)	.919	.980	.035	.127	.004	1.000		1.000	1.000	.000
	N	57	57	57	57	57	57	57	57	57	57
innovation and learning	Pearson Correlation	.255	.161	-.262*	.206	.142	.000	.000	1	.000	.500**
	Sig. (2-tailed)	.056	.231	.049	.124	.293	1.000	1.000		1.000	.000
	N	57	57	57	57	57	57	57	57	57	57
time and cost outcomes	Pearson Correlation	-.018	.064	.078	-.189	-.175	.000	.000	.000	1	-.500**
	Sig. (2-tailed)	.892	.635	.566	.160	.192	1.000	1.000	1.000		.000
	N	57	57	57	57	57	57	57	57	57	57
overall performance	Pearson Correlation	.279*	.137	.146	.169	.382**	.500**	-.500**	.500**	-.500**	1
	Sig. (2-tailed)	.035	.309	.280	.208	.003	.000	.000	.000	.000	
	N	57	57	57	57	57	57	57	57	57	57

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

H&S and quality outcomes are significantly and negatively related to team orientation (r = -.280, p = .035) and the project orientation (r = -.375, p = .004). This means that as both the team and project orientations improve, H&S and quality also improves. Innovation and learning outcomes are significantly and negatively related to team orientation (r = -.262, p = .049), which means that higher team orientations were associated with lower levels of innovation and learning. Overall performance is significantly and positively related to workforce orientation (r = .279, p = .035) and project orientation (r = .382, p = .003). This means that as workforce orientation and project orientation improves on construction projects, so does the overall performance. Interestingly, there was no evidence found in the data to suggest that there is an association between the dimensions of performance orientation and client orientation and any of the measures of performance.

Whilst none of the relationships exposed in the correlation matrix confirm causality *per se* for reasons discussed in Field (2000) such as the *third variable* problem, they may be indicative of underlying causal relationships and as such require further exploration. What they do confirm however is that there are significant linear relationships. Where the relationship is positive, an increase in one variable will correspond with an increase in the other variable, and where the relationship is negative, an increase in one variable will correspond with a decrease in the other variable. It can therefore be inferred from the results that there is sufficient evidence of linear relationships to proceed with the regression modelling.

8.3 MODELLING THE RELATIONSHIP BETWEEN CULTURE AND PERFORMANCE

It has been noted in Field (2000) that whilst correlations are a useful research tool for examining the relationships between variables, they provide little information about the predictive power of the individual variables. Because regression modelling provides the means of assessing the predictive ability of individual variables, multiple regression was applied to the data to try and identify the cultural variables with the most predictive power for each measure of performance. The results are presented below.

8.3.1 Culture and participant satisfaction outcomes

To identify which factors influence participant satisfaction outcomes, multiple regression analysis was applied to the data with all five dimensions of culture included as predictors and participant satisfaction as the outcome variable. The stepwise method of variable selection was used and output in Table 8.2 was obtained.

One predictor was selected for inclusion in the model as shown in Table 8.2. The selected predictor was *team orientation*. The value of R^2 for the model generated is .123, implying that team orientation accounts for 12.3% of the variation in the satisfaction of participants.

Table 8.2 Regression analysis results for participant satisfaction

R	.351	Std. Error	.94497				
R^2	.123	Adjusted R^2	.107				
Durbin-Watson	1.824						
Analysis of variance	df	Sum of Squares	Mean Square	F	Sig.		
Regression	1	6.886	6.886	7.712	.007		
Residual	55	49.114	.893				
Total	56	56.000					
Variables in equation	B	Std. Error	Beta	T	Sig.	Tolerance	VIF
(Constant)	-.029	.126		-.233	.817		
team orientation	.413	.149	.351	2.777	.007	1.000	1.000

The ANOVA (Table 8.2) which tests whether or not the model is a useful predictor of participant satisfaction gives a highly significant result (F = 7.712, p = .007), indicating that this model significantly improves the prediction of satisfaction of participants.

Table 8.2 also provides the actual parameters of the regression model. From this table, the final regression equation for participant satisfaction can be presented as:

PARTICIPANT SATISFACTION = -.029 + .413 (TEAM ORIENTATION)

The predictor team orientation, clearly makes a significant contribution to this model ($t = 2.777$, $p = .007$), and the VIF (variance inflation factor) of 1.000 obtained indicates that there is no collinearity within the data (Field, 2000).

The four other variables eliminated through the regression were (i) workforce orientation, (ii) client orientation, (iii) performance orientation, and (iv) project orientation.

8.3.1.1 Testing the assumptions of regression

To test the assumptions of the regression, an analysis of residuals was undertaken. Plots of the residuals are shown in Figures 8.1, 8.2 and 8.3. The histogram shows a bell-shaped distribution indicating that the assumption of normality has not been violated. The normal probability plot of expected cumulative probability against observed cumulative probability also shows points generally lying close to the straight line indicating that the residuals are approximately normally distributed thus confirming the conclusions drawn from histogram.

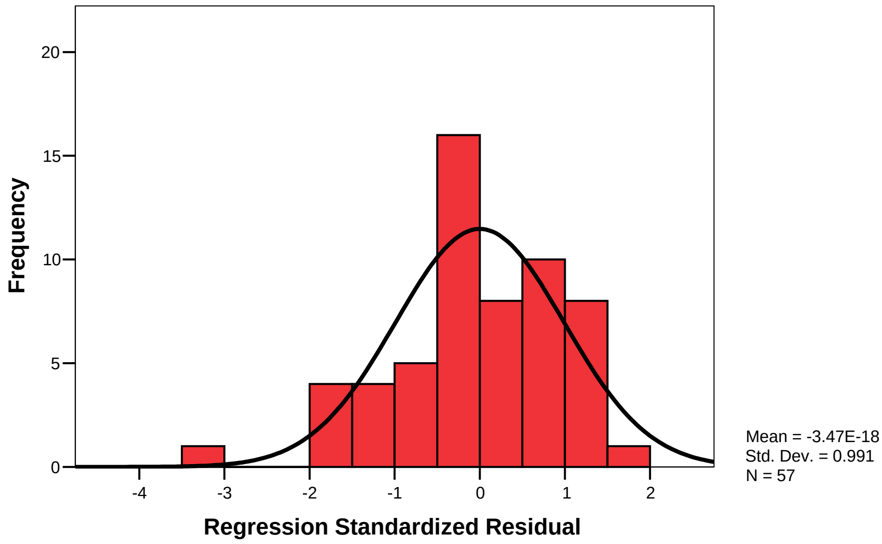

Figure 8.1 Histogram of standardised residuals for participant satisfaction model

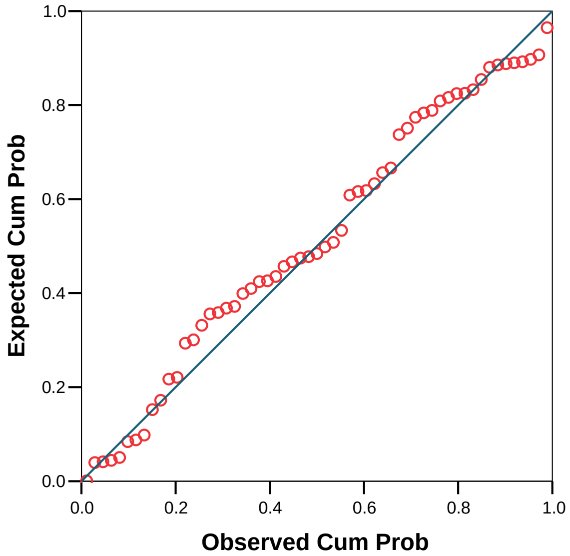

Figure 8.2 Normal P-P plot of regression standardised residual for participant satisfaction model

Linearity of the relationship between variables was assessed by examining Figure 8.3. The random distribution of data points indicates that there is no evidence of a non-linear relationship and therefore this assumption has also not been violated. There is also no evidence of heteroscedasticity in the scatterplot, implying that the assumption of constant variance is valid.

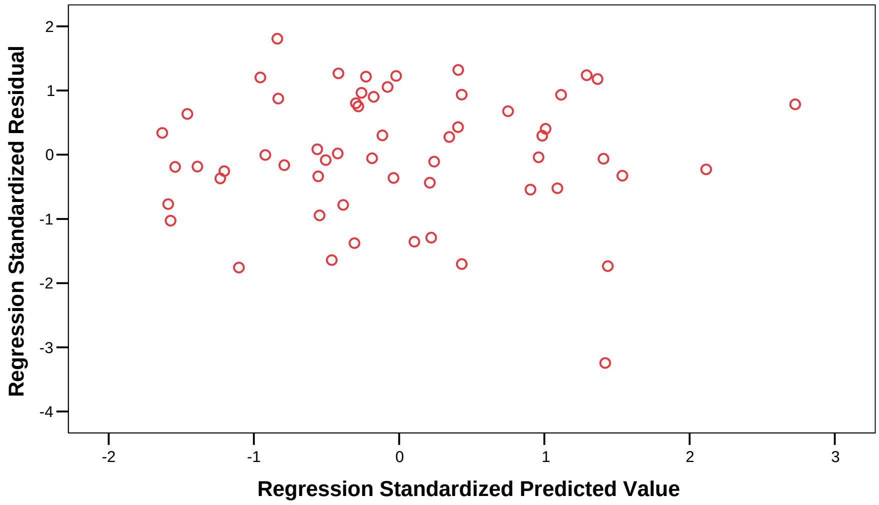

Figure 8.3 Scatterplot of standardised residual against predicted value for participant satisfaction model

To test for the independence of the error terms, the Durbin-Watson statistic was obtained (Table 8.2). Its value of 1.824 is very close to 2 indicating that this assumption has also not been violated.

Taken together, these findings indicate that the regression model produced is an accurate and valid representation of the data and can be applied to the population.

8.3.1.2 Discussion

The multiple regression analysis revealed that higher levels of team orientation are associated with higher levels of participant satisfaction. Whilst this does not prove causality, it is significant that the projects with higher levels of team orientation are also the ones with the higher levels of participant satisfaction. These results may indeed be indicative of an underlying causal relationship and therefore require deeper examination. Indeed team orientation is not the only important cultural factor but also workforce orientation as revealed by the correlation matrix.

As explained in Chapter 7, team orientation encompasses blame culture (or absence of it), the extent to which management is accessible and approachable, amount of information sharing, the degree of trust, and to a minor extent the avoidance of innovation. Because of the fragmented nature of construction, a high team orientation with better integration, cooperation and coordination of construction project teams has been identified as a prerequisite for project success (Cicmil and Marshall, 2005). Indeed, this concurs with many other views expressed about the importance of teamwork for successful project delivery (cf. Latham, 1994; Egan, 1998; Soetanto *et al.*, 1999; Rowlinson and Cheung, 2004; Baiden *et al.*, 2006). Team orientation leads to an environment where there is trust and open communication, information is freely exchanged between the different participants, and there is an open book policy. It has been suggested that greater team orientation also reduces the propensity for litigation (Fenn *et al.*, 1997; Phua and Rowlinson, 2003) which has obvious implications for satisfaction levels. The empirical evidence from this research thus provides support for these assertions by demonstrating that there is an association between team orientation and participant satisfaction. The calls for improvement in team orientation (cf. Egan 1998) are therefore justified. As noted in Baiden *et al*. (2006), improving teamwork would involve the introduction of working practices, methods and behaviours that create a culture of efficient and effective collaboration by individuals and organisations.

Although not captured in the regression model, Table 8.1 confirms that workforce orientation which encompasses the amount of effort put into motivating the workforce, emphasis on teamwork, the extent of free and open communication on site, the emphasis on site tidiness, recognition of good performance, keeping operatives informed of project developments, the extent of participation in planning and decision-making by the workforce, and communication between managers and operatives, also has a positive relationship with participant satisfaction. The importance of workforce orientation is corroborated by evidence in Liu (1999) and Zuo and Zillante (2006). Workforce orientation, generally speaking, is not an area for which the UK construction industry is renowned for exemplifying good practice (Fellows *et al.*, 2002). As shown in Table 6.11, CPOs are generally moderate in orientation in respect of aspects like recognising good performance, keeping operatives informed and participation in planning and decision-making, and just above moderate in respect of the other dimensions. Improvements in regard of these aspects are therefore called for.

8.3.2 Culture and H&S and quality outcomes

In this research, H&S and quality were identified by survey respondents as the two most important objectives pursued by CPOs. In order to identify which cultural factors influence these H&S and quality outcomes, the stepwise multiple regression procedure was again applied to the data with all five dimensions of culture included as predictors and H&S and quality as the outcome variable. Results are shown in Table 8.3.

Table 8.3 Regression analysis results for H&S and quality outcomes

R	.450	Std. Error	.90957				
R^2	.202	Adjusted R^2	.173				
Durbin-Watson	2.012						
Analysis of variance	df	Sum of Squares	Mean Square	F	Sig.		
Regression	2	11.325	5.662	6.844	.002		
Residual	54	44.675	.827				
Total	56	56.000					
Variables in equation	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	.031	.121		.256	.799		
project orientation	-.344	.119	-.353	-2.895	.005	.992	1.008
team orientation	-.293	.144	-.249	-2.041	.046	.992	1.008

Under the selection criteria, two predictors were selected for inclusion in the model. The two predictors are *project orientation* and *team orientation* confirming the results from the correlation matrix. From Table 8.3, the final regression equation for H&S and quality outcomes can be expressed as:

H&S AND QUALITY = .031 - .344 (PROJECT ORIENTATION) - .293 (TEAM ORIENTATION)

The value of R^2 for the model generated is .202, implying that project orientation and team orientation account for 20% of the variation in the H&S and quality outcomes. Project orientation alone accounts for 14% of the variation in the H&S and quality outcomes.

The ANOVA which tests whether or not the model is a useful predictor of H&S and quality, gives a highly significant result ($F = 6.844$, $p = .002$), indicating that this model significantly improves the prediction of H&S and quality outcomes.

Both predictors clearly make a significant contribution to this model. The t-test for project orientation gives very strong evidence that it is worth having this variable in the model ($t = -2.895$, $p = .005$). The t-test for team orientation gives some evidence that it is worth having this variable in the model ($t = -2.041$, $p = .046$). The VIF of 1.008 obtained indicates that there is no collinearity within the data (Field, 2000).

The three other variables eliminated through the regression were (i) workforce orientation, (ii) client orientation, and (iii) performance orientation.

8.3.2.1 Testing the assumptions of regression

To test the assumptions of the regression, an analysis of residuals was undertaken. Plots of the residuals are shown in Figures 8.4, 8.5 and 8.6. The histogram shows a bell-shaped distribution with the normal probability plot also showing points generally lying close to the straight line indicating that the assumption of normality has not been violated.

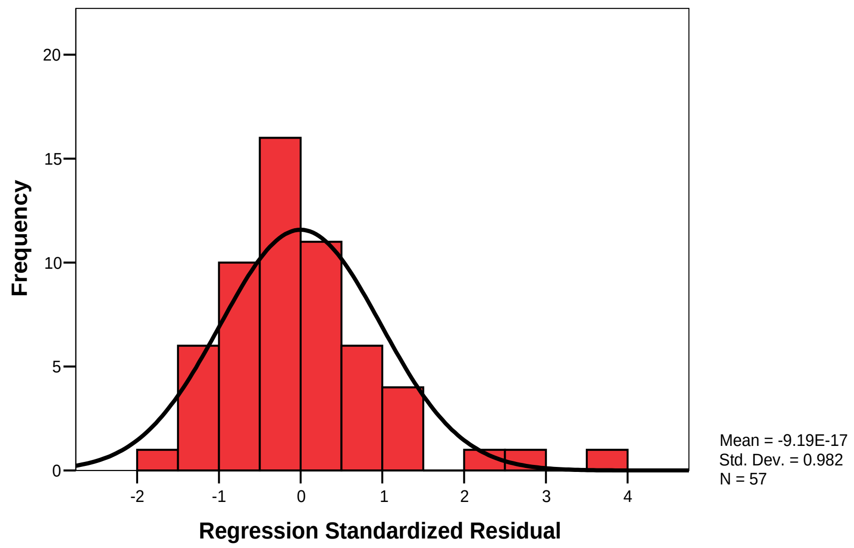

Figure 8.4 Histogram of standardised residuals for H&S and quality model

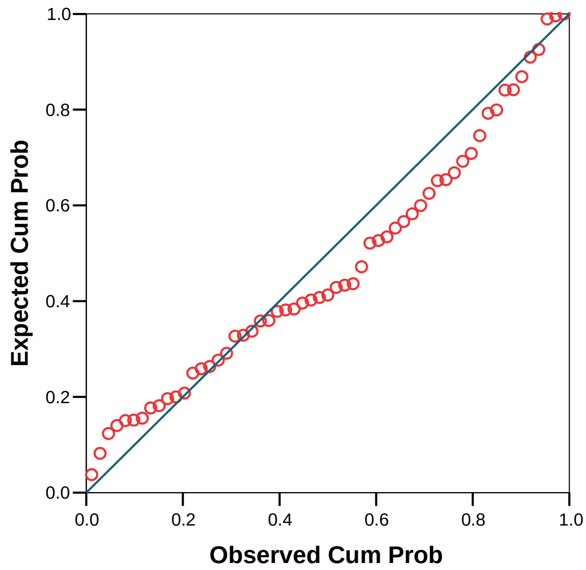

Figure 8.5 Normal P-P plot of regression standardised residual for H&S and quality model

Linearity of the relationship between variables was assessed by examining Figure 8.6. The random distribution of data points indicates that there is no evidence of non-linear relationships and therefore this assumption has also not been violated. Apart from this, there is also no evidence of heteroscedasticity in the scatterplot, implying that the assumption of constant variance is valid.

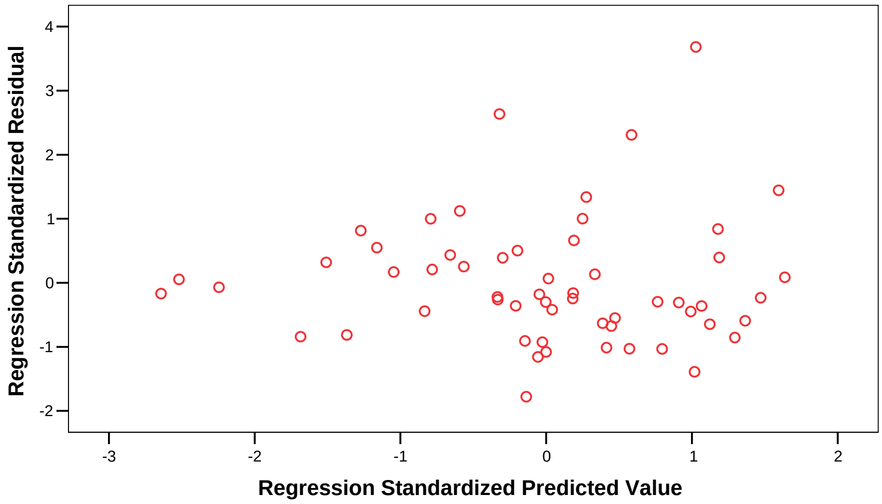

Figure 8.6 Scatterplot of standardised residual against predicted value for H&S and quality model

To test for the independence of the error terms, the Durbin-Watson statistic was obtained (Table 8.3). Its value of 2.012 is very close to 2 indicating that this assumption has also not been violated.

Taken together, these findings indicate that the regression model produced is an accurate and valid representation of the data and can be applied to the population.

8.3.2.2 Discussion

The multiple regression analysis revealed that higher levels of project orientation and team orientation are associated with improved levels of H&S and quality outcomes. Again whilst this does not prove causality, this result appears to suggest that the project and team orientations are important aspects for CPOs to consider if H&S and quality outcomes of construction projects are to be improved.

The H&S and quality outcomes of a construction project relates to accidents reported, injuries occurring, near misses reported, extent of defects, and the level of absenteeism. Higher project and team orientations are therefore associated with a reduction in the numbers associated with these occurrences. Higher project orientation implies that project participants identify more with the project, there is less subcontracting (greater use of direct labour), and more effort is put into waste elimination. One plausible reason for this association with better H&S and quality outcomes, borrowing from findings in Hsieh (1998), is that project orientation which encompasses housekeeping on-site worsens with an increase in subcontracting. Subcontractors are notorious for poor housekeeping, a fact even noted by interviewees (during the qualitative phase of this research) when one of them stated in reference to subcontractors that "*they'll always make a mess*". Housekeeping includes waste cleanup, organisation of tools and materials, inspection of stairs, passageways and openings, and maintenance of site utilities such as electrical power, water, gas, toilet, drainage, and lighting (Hsieh, 1998). These aspects if not properly attended to, can increase 'opportunities' for accidents and therefore have negative consequences on H&S on site as found in Sawacha *et al.* (1999), and also lead to loss of motivation and consequently absenteeism.

Typically, the relationship between contractors and subcontractors is "traditional, cost-driven, and potentially adversarial" (Greenwood, 2001). It has also been found that subcontractors often have different objectives and aspirations (Riley and Clare-Brown, 2001). From this it can be inferred that lower project orientation often associated with greater levels of subcontracting will lead to greater segregation or "islands" (Hsieh, 1998) and more pronounced out-group discrimination (Phua and Rowlinson, 2004). The effect of this is that participants take less responsibility for the H&S of workers who belong to the out-group and are less likely to take any action if for instance they find them working unsafely. Besides these issues, because of the financial burdens often imposed on subcontractors as a result of risk shedding by the main contractor (Hsieh, 1998; Costantino *et al.*, 2001), subcontractors tend not to value work ethics, invest in human resources, upgrade managerial ability, and skills and technology advancement (Hsieh, 1998). It is therefore not surprising that quality also suffers when project orientation declines. This finding is supported by Love and Heng (2000) which also found that damage by subcontractors and poor workmanship were the primary causes of defects.

As explained earlier, team orientation has to do with better integration, active cooperation and coordination of construction project teams. Its association with H&S and quality outcomes is also supported by previous research in this domain. Thomas *et al.* (2002) for instance posit that teamwork within the supply chain is essential for the achievement of planned quality outcomes, with greater levels of teamwork leading to improved quality outcomes. It has also been argued in Xiao and Proverbs (2002c) that a culture dominated by short-term financial considerations and reflected in uncooperative, antagonistic and suspicious relationships with accusations, recriminations and blame common, as found by Shammas-Toma *et al*. (1998), undoubtedly has a negative influence on the quality performance of UK contractors. The evidence from this research provides support for this thesis as shown by the regression model above. With greater levels of team orientation, participants are also more likely to take responsibility for each others welfare and as such are unlikely to walk by unconcerned if they find other participants working unsafely, hence the positive and significant association between team orientation and performance outcomes.

8.3.3 Culture and innovation and learning outcomes

In this research, innovation and learning were generally rated as moderate, a reflection of the slow rate of change within construction. In order to identify which cultural factors were most significantly related to these innovation and learning outcomes, and the magnitude of their influence, the stepwise multiple regression procedure was again applied to the data with all five dimensions of culture included as predictors and innovation and learning as the outcome variable. Results are shown in Table 8.4.

Table 8.4 Regression analysis results for innovation and learning

R	.406	Std. Error	.93065				
R^2	.165	Adjusted R^2	.134				
Durbin-Watson	1.881						
Analysis of variance	df	Sum of Squares	Mean Square	F	Sig.		
Regression	2	9.230	4.615	5.328	.008		
Residual	54	46.770	.866				
Total	56	56.000					
Variables in equation	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	.045	.124		.359	.721		
team orientation	-.379	.149	-.322	-2.540	.014	.964	1.037
workforce orientation	.314	.126	.316	2.495	.016	.964	1.037

Under the selection criteria, two predictors were selected for inclusion in the model. The two predictors are *team orientation* and *workforce orientation*. From Table 8.4, the final regression equation for innovation and learning outcomes can be expressed as:

INNOVATION AND LEARNING = .045 - .379 (TEAM ORIENTATION) + .314 (WORKFORCE ORIENTATION)

The value of R^2 for the model generated is .165, implying that team orientation and workforce orientation account for 16.5% of the variation in the innovation and learning outcomes. The ANOVA (Table 8.4) which tests whether or not the model is a useful predictor of innovation and learning, gives a highly significant result (F = 5.328, p = .008), indicating that this model significantly improves the prediction of innovation and learning outcomes.

Both predictors clearly make a significant contribution to this model. The t-test for team orientation gives some evidence that it is worth having this variable in the model ($t = -2.540$, $p = .014$). The t-test for workforce orientation also gives some evidence that it is worth having this variable in the model ($t = 2.495$, $p = .016$). The VIF of 1.037 obtained indicates that there is no collinearity within the data (Field, 2000).

The three other variables eliminated through the regression were (i) performance orientation, (ii) client orientation, and (iii) project orientation.

8.3.3.1 Testing the assumptions of regression

To test the assumptions of the regression, an analysis of residuals was undertaken. Plots of the residuals are shown in Figures 8.7, 8.8 and 8.9. The histogram shows a bell-shaped distribution with the normal probability plot also showing points generally lying close to the straight line to indicate that the assumption of normality has not been violated.

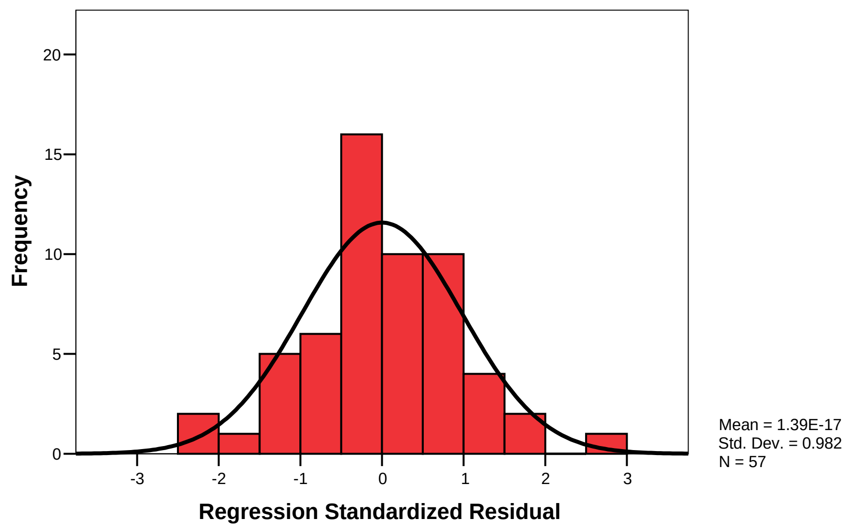

Figure 8.7 Histogram of standardised residuals for innovation and learning model

Linearity of the relationship between variables was assessed by examining Figure 8.9. The random distribution of data points indicates that there is no evidence of non-linear relationships and therefore this assumption has also not been violated. Apart from this, there is also no evidence of heteroscedasticity in the scatterplot, implying that the assumption of constant variance is valid.

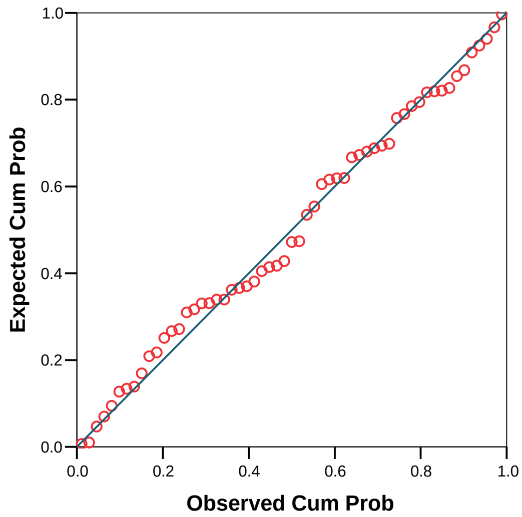

Figure 8.8 Normal P-P plot of regression standardised residual for innovation and learning model

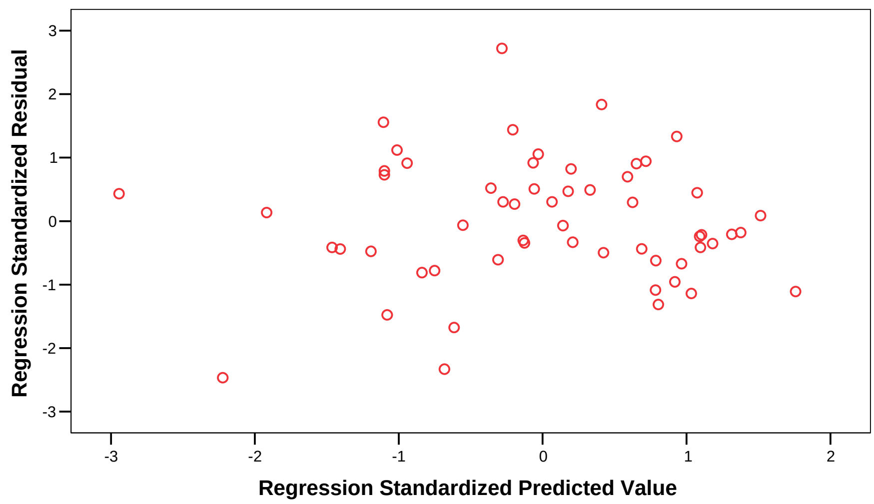

Figure 8.9 Scatterplot of standardised residual against predicted value for innovation and learning model

To test for the independence of the error terms, the Durbin-Watson statistic was obtained (Table 8.4). Its value of 1.881 is very close to 2 indicating that this assumption has also not been violated.

Taken together, these findings indicate that the regression model produced is an accurate and valid representation of the data which can be applied to the population.

8.3.3.2 Discussion

The multiple regression analysis revealed that higher levels of team orientation are associated with lower levels of innovation and learning. This represents perhaps one of the most surprising findings of this survey, as it seems to suggest that high levels of innovation and learning cannot be achieved without compromising team orientation. Although this outcome appears to contradict logical thinking (cf. Kululanga *et al.*, 2001), there are logical reasons why such an outcome is evident in the projects sampled. To some extent this finding can be attributed to the fact that learning normally takes place in the face of the mistakes and failures that often accompany attempts to be creative or innovative. Unfortunately, with a high risk low margin industry like construction, mistakes are not acceptable. Consequently, as CPOs strive to maintain or improve team orientation, conscious efforts are made to avoid errors and mistakes and this inevitably stifles creativity, innovation and learning. This finding is also possibly a reflection of the unconstructive manner in which conflicts are handled (Hartmann, 2006). It should also be recalled that by definition (refer Chapter 6) team orientation also encapsulates the avoidance of innovation.

Workforce orientation on the other hand was found to be positively associated with innovation and learning. As workforce orientation improves CPOs exhibit greater levels of innovation and learning. As noted in Kululanga *et al.* (2001), some of the factors that support learning and in particular reflective or generative learning include a climate of openness, rewarding innovations, leadership commitment to learning, a common sense of direction, encouragement of employees to update their values. Hartman

(2006) also identifies similar factors as advantageous for innovation. These factors are all key aspects of workforce orientation (Chapter 7 refer), explaining why workforce orientation is directly associated with the amount of innovation and learning that takes place. Indeed, the cultural dimension of learning on the project is also one of the dimensions subsumed under workforce orientation (Table 6.14). The greater the emphasis on these dimensions, the greater the innovation and learning outcomes on the project.

8.3.4 Culture and time and cost outcomes

To identify which factors influence time and cost outcomes, the multiple regression analysis was repeated with all five dimensions of culture included as predictors and time and cost outcomes included as the outcome variable. Here also, stepwise regression was applied as the method of variable selection.

The stepwise regression failed to identify and include any of the variables in a model to predict the time and cost outcomes, confirming the correlation matrix results (Table 8.1). It can be suggested from this result that cultural orientations are not very useful predictors of time and cost outcomes. This finding also reflects the fact that perhaps other factors not considered in this research are more critical in determining time and cost outcomes of a construction project. Examples of some of the factors catalogued in existing research include design changes, labour productivity, planning, resources, inflation, errors in taking-off, project complexity, time devoted by project manager, frequency of meetings, monetary incentives to designer, implementation of constructability programme, and project manager's experience on similar projects (Kaming *et al.*, 1997; Kog *et al.*, 1999). In this research as highlighted in Chapter 8, respondents identified variations, making good defects, poor project management, inclement weather and labour problems as some of the factors determining time and cost outcomes.

8.3.5 Culture and overall performance

Having evaluated project performance along participant satisfaction, H&S and quality outcomes, innovation and learning, and time and cost outcomes, it was considered necessary to develop an index of overall performance based on an aggregation of the individual performance measures. Following the precedent of Xiao and Proverbs (2003), equal weighting was applied to each of the principal performance measures. In order to identify which cultural factors are associated with the overall project performance, the stepwise multiple regression procedure was again applied to the data with all five dimensions of culture included as predictors and overall performance as the outcome variable. Results are shown in Table 8.5.

Table 8.5 Regression analysis results for overall performance

R	.478	Std. Error	.44724				
R^2	.228	Adjusted R^2	.200				
Durbin-Watson	1.974						
Analysis of variance	df	Sum of Squares	Mean Square	F	Sig.		
Regression	2	3.199	1.599	7.996	.001		
Residual	54	10.801	.200				
Total	56	14.000					
Variables in equation	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	.002	.059		.041	.967		
project orientation	.189	.058	.388	3.246	.002	1.000	1.000
workforce orientation	.143	.059	.287	2.400	.020	1.000	1.000

Under the selection criteria, two predictors were selected for inclusion in the model. The two predictors are *project orientation* and *workforce orientation* confirming the results from the correlation matrix. From Table 8.5, the final regression equation for overall performance can be presented as:

OVERALL PERFORMANCE = .002 + .189 (PROJECT ORIENTATION) + .143 (WORKFORCE ORIENTATION)

The value of R^2 for the model generated is .228, implying that project orientation and team orientation account for about 23% of the variation in overall performance. Project orientation alone accounts for 14% of the variation in overall performance. The ANOVA (Table 8.5) which tests whether or not the model is a useful predictor of overall performance, gives a highly significant result ($F = 7.996$, $p = .001$), indicating that this model significantly improves the prediction of overall performance.

Both predictors clearly make a significant contribution to this model. The t-test for project orientation gives very strong evidence that it is worth having this variable in the model ($t = 3.246$, $p = .002$). The t-test for workforce orientation gives some evidence that it is worth having this variable in the model ($t = 2.400$, $p = .020$). The VIF of 1.000 obtained indicate that there is no collinearity within the data (Field, 2000).

The three other variables eliminated through the regression were (i) performance orientation, (ii) team orientation, and (iii) client orientation.

8.3.5.1 Testing the assumptions of regression

To test the assumptions of the regression, an analysis of residuals was undertaken. Plots of the residuals are shown in Figures 8.10, 8.11 and 8.12. The histogram shows a bell-shaped distribution indicating that the assumption of normality has not been violated. The normal probability plot of expected cumulative probability against observed cumulative probability also shows points generally lying close to the straight line indicating that the residuals are approximately normally distributed thus confirming the conclusions drawn from histogram.

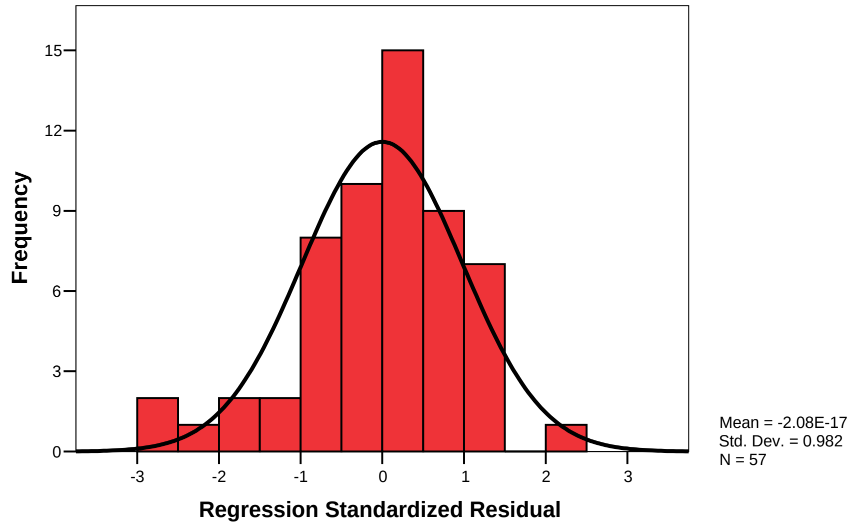

Figure 8.10 Histogram of standardised residuals for overall performance model

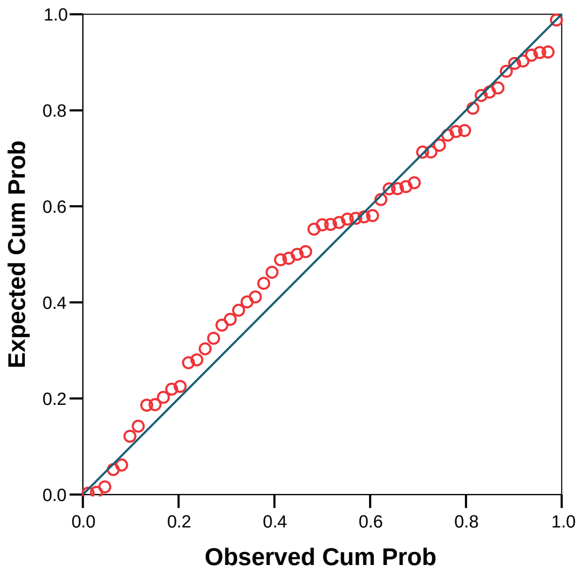

Figure 8.11 Normal P-P plot of regression standardised residual for overall performance model

Linearity of the relationship between variables was assessed by examining Figure 8.12. The random distribution of data points indicates that there is no evidence of non-linear relationships and therefore this assumption has also not been violated. Apart from this, there is also no evidence of heteroscedasticity in the scatterplot, implying that the assumption of constant variance is valid.

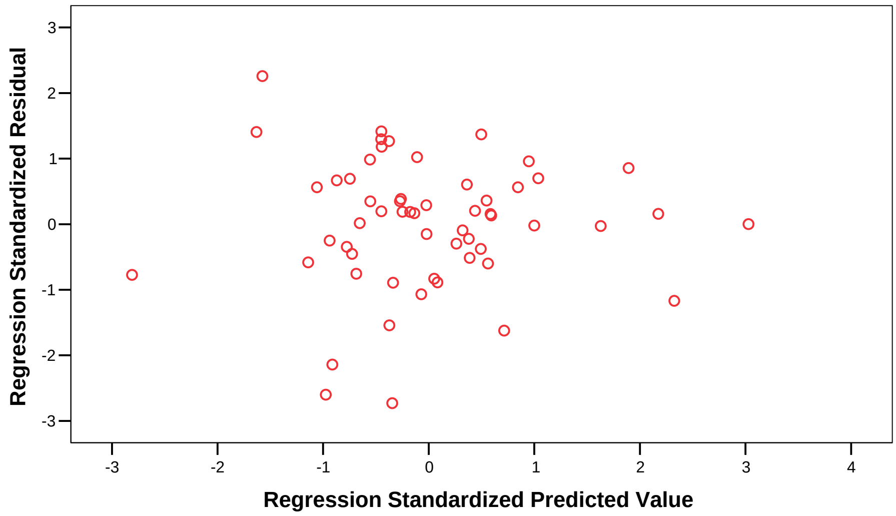

Figure 8.12 Scatterplot of standardised residual against predicted value for overall performance model

To test for the independence of the error terms, the Durbin-Watson statistic was obtained (Table 8.5). Its value of 1.974 is very close to 2 indicating that this assumption has also not been violated. All these findings indicate that the regression model produced is an accurate and valid representation of the data which can be applied to the population.

8.3.5.2 Discussion

The regression analysis shows that when all the performance outcomes are aggregated to form an overall performance index, project orientation and workforce orientation emerge as the two most important variables to consider. In other words, the primacy of the project and the primacy of the human resources are the two cultural variables of paramount importance when striving for improved overall performance outcomes. These two variables account for 23% of the variation in performance outcomes and as such cannot be taken for granted. As construction organisations strive for improved performance outcomes, it is essential that adequate resources are devoted towards the improvement of project orientation and workforce orientation. Researchers looking into project or contractor performance must also address these aspects in order to evolve comprehensive frameworks for performance improvement.

This is not however to suggest that the other dimensions of culture i.e. performance orientation, team orientation and client orientation are not important. What it does indicate though is that there was insufficient evidence to establish their degree of importance.

8.4 VALIDATION OF MODELS

Having developed the models showing the impact of culture on project performance outcomes, there is a further requirement to test the generalisability and transferability of the results to the wider population of construction projects. This is model validation. For this validation, the 21 questionnaires that had been held back from the main analysis were used as an independent sample of cases. It is recognised that mathematical models usually fit the sample from which they are derived better than they will fit another sample from the same population (Tam and Harris, 1996). As argued *ibid*, the observed error rate in this test sample will better reflect the models' effectiveness. Where appropriate, the missing values were replaced with the mean of all valid responses, as in the case of the original analysis.

Given that the outcome of the multiple regression analysis gave R^2 values the largest of which was 23% (implying that several other factors not accounted for in this study account for the variation in the performance outcomes), it can be seen that the predictive use of these developed models is limited. It can therefore be argued that trying to validate these models by attempting to directly predict the exact project performance of the new cases will be unlikely to yield satisfactory results. However to confirm the validity of the models, such predicted results should give the same general indication of performance as the actual performance outcomes. Given that the performance variables in the models had been standardised (mean = 0, standard dev. = 1) implying that positive outcomes represent above average performance whilst negative outcomes represent below average performance, it is contended that for the models to be considered valid, they should be able to give a reasonable indication of above average, average or below average performance.

The validation process thus sought to assess the extent to which the models predict the outcomes in terms of performance above or below average. Table 8.6 below shows the degree to which predicted performance outcomes fit the actual outcomes of the construction projects in the held-back sample standardised in the same way as the original sample using the component score coefficient matrix shown in Table 3 (Appendix M).

From Table 8.6, the average percentage of accurate predictions in terms of performance above or below average is 62% for all the models, which is a reasonable outcome (albeit inconclusive) given that the R^2 values for the models ranged from approximately 12% to 23%. This outcome does suggest that performance outcomes can be predicted better with the models than without it. Indeed these results provide even stronger evidence of model validity than those reported for instance in Omoregie (2006) in which the percentages of hold-back cases validating the derived models ranged from approximately 13% to 58%.

Because of the inconclusive nature of the validation efforts reported in this section, a further validation of findings of this research was undertaken making use of qualitative data provided by construction industry experts.

This approach is in line with the concepts of triangulation and respondent validation, and the findings are reported in the next chapter.

Table 8.6 Predictive fit of the regression models

Participant Satisfaction			H&S and Quality outcomes			Innovation and Learning			Overall Performance		
Predicted	Actual		Predicted	Actual		Predicted	Actual		Predicted	Actual	
-0.537	1.533	×	0.206	-0.507	×	0.337	1.018	✓	0.025	0.371	✓
0.095	0.047	✓	0.022	5.686	✓	-0.220	-1.066	✓	-0.110	-1.628	✓
-0.044	-0.276	✓	-0.191	-0.688	✓	0.444	0.323	✓	0.305	0.295	✓
-0.491	-0.320	✓	-0.095	-0.742	✓	0.762	0.612	✓	0.385	0.330	✓
-0.214	-0.097	✓	0.409	-0.533	×	0.435	-0.340	×	-0.033	0.065	×
-0.431	-0.250	✓	0.188	1.204	✓	-0.065	-0.729	✓	-0.145	-0.592	✓
-0.221	-0.300	✓	0.248	-0.510	×	0.170	-0.159	×	-0.066	0.066	×
0.219	-0.090	×	-0.238	-0.836	✓	-0.278	-0.245	✓	0.009	0.220	✓
0.035	-0.191	×	0.042	0.367	✓	-0.216	-0.561	✓	-0.121	-0.207	✓
0.162	0.736	✓	-0.354	0.001	×	-0.086	-0.868	✓	0.159	-0.186	×
-0.013	0.156	×	0.312	0.470	✓	0.144	0.446	✓	-0.107	0.101	×
0.167	-0.347	×	-0.115	3.334	×	-0.435	0.228	×	-0.131	-0.830	✓
0.001	0.208	✓	0.076	-0.995	×	-0.351	-0.142	✓	-0.203	0.148	×
-0.260	-0.425	✓	0.010	-0.411	×	0.105	-0.343	×	0.035	-0.002	×
-0.277	0.154	×	-0.103	0.109	×	0.100	-0.250	×	0.094	-0.019	×
-0.092	-0.057	✓	0.081	0.478	✓	0.379	0.214	✓	0.125	-0.009	×
0.039	0.467	✓	0.038	3.968	✓	0.074	0.044	✓	0.013	-0.798	×
0.218	-0.160	×	-0.653	-1.256	✓	-0.263	-0.050	✓	0.245	0.347	✓
0.222	0.204	✓	-0.368	-1.032	✓	-0.272	-0.543	✓	0.084	0.242	✓
Accurate predictions		12			11			14			10
Accurate predictions (%)		63			58			74			53

✓ - Accurate predictions
× - Wrong predictions

8.5 DISCUSSION

The main aim of this research was to establish empirically the extent to which the culture within a CPO impacts on project performance outcomes. As shown in Chapter 3, there is widespread recognition that culture does have an impact on performance (c.f. Fenn *et al.*, 1997; Cooper, 2000; Ngowi, 2000; Thomas *et al.*, 2002; Phua and Rowlinson, 2003). However as argued in Ankrah *et al.* (2007b), many of these associations between culture and performance are arbitrary and subjective. Going beyond the arbitrariness and subjectivity based on anecdotal evidence, this research has sought to reveal empirical evidence that links the cultural orientation with project performance outcomes.

The links found between cultural orientation and project performance outcomes are captured in Figure 8.13 which shows the overall model based on the aggregation of the regression models for the different performance measures. This model shows in a simple fashion the nature of the relationships between the dimensions of culture and the performance measures (whether positive or negative) and the magnitudes by which performance outcomes change for corresponding changes in the dimensions of culture (represented by the coefficients).

These relationships are however associated with relatively small coefficient of determination (R^2) values ranging from approximately 12% to 23%. Bearing in mind the aim of this research, the relatively small R^2 values are not surprising at all. Indeed this outcome goes some way to substantiate other studies undertaken on project performance which have pointed to other factors impacting on performance (cf. Ching Ming and Harris, 1996; Assaf *et al.*, 1996; Russell *et al.*, 1997; Hatush and Skitmore, 1997b; Ng and Skitmore, 1999; Chan *et al.*, 2004; Belout and Gauvreau, 2004). It is also important to emphasise that the low R^2 values do not in any way diminish the significance of the relationships revealed by the models. Whilst the predictive utility of these models is limited by the fact that the cultural dimensions account for a relatively small proportion of the variability in performance outcomes (12% - 23%), these models expose significant relationships which are real and not just due to chance. Models with similar R^2 values are present in the research literature (cf. Leung *et al.*, 2005; Omoregie, 2006). Omoregie (2006) for instance reported R^2 values ranging from 4% to 26%.

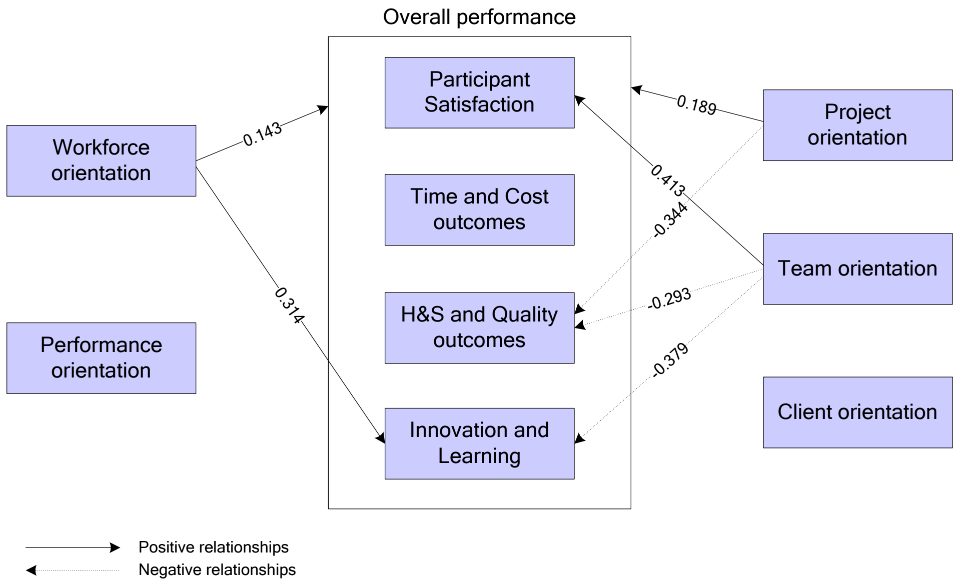

Figure 8.13 A pictorial representation of the regression results

It can be surmised from these results that workforce orientation is significantly associated with project performance outcomes. Construction projects with higher levels of workforce orientation achieved higher levels of innovation and learning, and overall performance. It is also positively associated with participant satisfaction although this is not shown in Figure 8.13. Improving workforce orientation implies increasing the effort put into motivating the workforce, emphasis on teamwork, free and open communication on site, emphasis on site tidiness, recognition of good performance, information flow to workforce, participation in planning and decision-making, communication between managers and operatives, and emphasis on learning, among other things. These are all attributes that according to the organisational behaviour and human resource scholars (cf. Robbins, 1998; Mullins, 2005), are important ingredients of organisational effectiveness. These aspects of workforce orientation have been linked to greater goal commitment and motivation (cf. McFillen and Maloney, 1988; Smithers and Walker, 2000), and as found in Leung *et al.* (2004) the greater the goal commitment, the greater the satisfaction of participants. The link to innovation and learning is also supported by the literature (cf. Kululanga *et* *al.*, 2001) which has argued for instance that learning is fostered by a greater workforce orientation.

Ultimately, construction projects will exhibit an overall performance improvement when workforce orientation within the CPO is improved.

The results also indicate that as CPOs improve in project orientation, they exhibit better H&S and quality outcomes, and an improved overall performance outcome. Project orientation refers to the sense of identification with the construction project which worsens as the level of subcontracting increases (Riley and Clare-Brown, 2001), a fact confirmed by the factor analysis. This finding is significant as it raises the fundamental question of what to do about subcontracting. Subcontracting is inevitable given the specialised, fragmented and uncertain nature of demand in construction (Hsieh, 1998; Gonzalez-Diaz *et al.*, 2000; Xiao, 2002). If project orientation is to be improved in spite of subcontracting, there is a need for measures to mitigate any negative consequences of subcontracting on project orientation and by extension H&S and quality outcomes. Measures could include induction, training and partnering (building long-term relationships with subcontractors). Other useful measures have also been identified in Sawacha *et al.* (1999). Indeed, some of these positive measures are actually being practiced by main contractors as indicated by interviewees *viz*:

> "*we will go out and will give them* (Subcontractors) *a free H&S briefing. We'll train their operatives for them in H&S…, to try and help them along. We will discuss with them where the shortfalls are. We'll identify what things we feel need to be put into place to put things right which will be discussed with them at the time. We'll set an action plan, we'll agree dates and then we'll go back at regular intervals see how they are doing, have they met the dates? If not, why not? What we need to do to bring the thing back on track?*

> *So there are reviews which go on all the way through the process from many different angles."*

Such measures, also referred to as positive management action by Sawacha *et al.* (1999), if embraced and applied fully can improve project orientation and by extension can also potentially lead to better H&S and quality outcomes. With H&S outcomes and quality outcomes being the first and second most important objectives that project organisations pursue (Chapter 6 refer), it is reasonable to recommend that project organisations give more attention to this cultural dimension of project orientation. Ultimately, construction projects that exhibit higher levels of project orientation will also potentially exhibit an overall performance improvement.

The other important dimension of culture is the team orientation. Projects that exhibited the higher participant satisfaction levels and better H&S and quality outcomes were those with the higher team orientations. The importance of this dimension of culture is underscored by the extensive literature and toolkits on team integration (cf. Latham, 1994; Egan, 2002; The Strategic Forum for Construction, 2003; Kadefors, 2004; Cicmil and Marshall, 2005; Baiden *et al.*, 2006). One of the ways by which the industry has sought to respond to the need for higher levels of team orientation has been the encouragement of partnering as an alternative procurement approach (Rowlinson and Cheung, 2004; Sullivan, 2006; OGC, 2007).

Improving team orientation is the very ethos of the partnering approach to project procurement. This was acknowledged by interviewees (in the qualitative phase) who appeared to favour the use of partnering as a procurement approach for generating the required team orientation stating *inter alia* that:

> *"The typical two stage or single stage lump sum price, is all about how do we fight each other,…whereas in a framework, a partnering agreement like BAA's framework, or the NHS Procure 21 as a framework,…it's about a project. Everybody's looking forward at how we get the job built and how we get the job completed on time. And it's a collaborative way of working to deliver that."*

It is often taken for granted that particular procurement routes like 'partnering' are the panacea for the poor team orientation of CPOs. Surprisingly, as shown in Chapter 6, there was no evidence on the projects surveyed where partnering was employed, that this procurement route led to greater levels of team orientation. This seems to corroborate views expressed in Sullivan (2006) that very often partnering is approached as a 'tick in the box' exercise, with participants not embracing the real cultural change it heralds. Perhaps it is time to rethink partnering.

Indeed, as demonstrated in the literature, several other factors contribute towards facilitating the process of integration with the aim of engendering a team culture. Baiden *et al*. (2006) for instance provide insights into practices that promote team integration, highlighting *inter alia* flat organisation structures, co-location, availability and accessibility of information, and flexibility within the project team. Such measures help to improve the situational context. However relating this to the social cognitive theory, it is also necessary to take measures that address the cognitive as well as the behavioural aspects. Training in teamwork through on-going workshops is key in this regards (Rowlinson and Cheung, 2004).

Curiously, it was also found that the projects with better innovation and learning outcomes were those with lower team orientations. This finding is consistent with research reported in Michela and Burke (2000). It has been noted that learning (and by extension innovation) does not happen by chance

(Kululanga *et al.*, 2001), but is a consequence of deliberate action (cf. Bresnen *et al.*, 2003). Taking such deliberate action has been a challenge for construction, especially at the project level where issues of who provides leadership, who owns the benefits, and who bears the risk for things going wrong are always at the fore (Chan *et al.*, 2005). Such issues are also at the core of a culture of teamwork. If issues like these can be resolved, there is a greater likelihood that greater innovation and learning can be fostered without compromising team orientation. Perhaps it is also time the construction industry reconsidered its efforts in propagating the notion that mistakes are not acceptable. Mantras like "right first time" which are regularly bandied about by practitioners and researchers alike, serve this purpose of signalling that mistakes are unacceptable. By these arguments, the position being taken is that there is no need for team orientation to be compromised in the pursuit of innovation and learning on the construction project. Rather, steps can be taken as indicated above to ensure that team orientation is maintained whilst pursuing innovation and learning as project objectives.

A curious finding in this research was the lack of empirical evidence to link either client or performance orientations with any of the performance outcomes. In trying to identify 'best practice' cultural orientations, it is tempting to propose on the basis of these findings that these dimensions are unimportant and can be ignored. However it should be noted that a lack of evidence to prove an association does not necessarily mean that such an association does not exist. Moreover, it is possible that there may be associations with performance outcomes not assessed in this research. Indeed it may well be that these dimensions are just enablers or enhancers of project success which by themselves cannot guarantee project success, but without which project success cannot be obtained (Nicolini, 2002). It is therefore not prudent without further external validation of this research involving a larger sample size to suggest that these dimensions of culture are unimportant.

What can be proposed however on the basis of the findings reported, is that workforce, project and team orientations have important roles to play in determining project performance outcomes. As such there is justification for undertaking further, perhaps more critical and in-depth research into these dimensions of culture. There is also justification for applying more effort and resources towards improving these orientations. Best practice cultural orientations in respect of these dimensions of culture can therefore be suggested as:

- A greater workforce orientation – encompassing a greater amount of effort put into motivating the workforce, emphasis on teamwork, free and open communication on site, emphasis on site tidiness, recognition of good performance. It also encompasses keeping operatives informed of project developments, a greater level of participation in planning and decision-making by the workforce, communication between managers and operatives, and so on.
- A greater project orientation – encompassing a greater level of identification with the project among participants, a greater emphasis on waste elimination, and a greater effort put into implementing measures that help align subcontractors' goals with project goals.
- A greater team orientation – encompassing the absence of a blame culture, a greater level of management accessibility and approachability, information sharing, and trust.

As construction organisations strive for improved performance outcomes, it is essential that adequate resources and attention are devoted towards improvements in these regards. These issues go to the heart of participants' commitment to the project and their motivation towards achieving the project objectives. Belout (1997) and Nicolini (2002) provide some useful practical pointers on how to foster these orientations including Project Manager training (in team building), co-location, early involvement of contractors and other suppliers project, appropriate contractual relations, appropriate team selection and composition (personal profile analysis), activities (including social activities) and workshops. Although addressing the retail sector, Ogbonna and Harris (2002) also provide some strategies that are worth exploring. Beyond just working to achieve these orientations, it has also been shown that for innovation and learning to flourish without compromising the team orientation, perhaps the industry must begin to recognise and educate participants that mistakes are acceptable, and encourage participants to resolve from the outset of the project the issues concerning leadership, who owns the benefits, and who bears the risk for things going wrong.

Considered together, these findings provide sound empirical evidence for accepting the main research hypothesis which posited that there is a significant relationship between the cultural orientations of CPOs and project performance outcomes. Clearly, there are significant relationships between cultural orientation as assessed through the dimensions of workforce orientation, project orientation and team orientation, and construction project performance outcomes. The statistics confirm that these associations are not just due to chance but are real. Although the amount of variation in performance outcomes culture accounts for is relatively small judging from the R^2 values, it is nevertheless significant enough to warrant greater attention from both the research fraternity and construction industry practitioners. In other words, culture within the project organisation matters.

It has been noted that one of the most important tasks of the Project Manager is to ensure that the optimum project culture is developed (Riley and Clare-Brown, 2001; Anderson, 2003). Through the development of these models which have helped to identify best practice, this research has provided some direction on what an optimum project culture ought to be. This is not however to suggest that there is a one best culture. As noted in Chapter 3 there is a need for congruence between the culture and its context

(Thompson, 1993; Kotter and Heskett, 1992) implying that certain contexts may give rise to particular orientations different from other contexts as found in Chapter 6. What is important is to be aware of the potential adverse impacts on outcomes so that steps can be taken to mitigate these effects.

8.6 SUMMARY

This chapter sought to explore the potential relationships between the operating cultures within the CPOs and the project performance outcomes to determine whether or not any significant association exists. Pearson's correlation coefficients and stepwise multiple regression were employed for this purpose.

It was found that significant associations exist between participant satisfaction and workforce and team orientation. Projects with higher participant satisfaction were generally those with the higher workforce and team orientations. Significant associations also exist between H&S and quality outcomes and project and team orientation. Projects with better H&S and quality outcomes were generally those with higher project and team orientations. Significant associations were also found between innovation and learning and workforce and team orientations. Projects with higher innovation and learning were generally those with higher workforce orientation, but lower team orientation. Finally for the overall performance index developed, significant associations were found with workforce and project orientations. Projects with better overall performance were those with higher workforce and project orientations. Although these relationships were found to be associated with relatively small R^2 values ranging from 12% to 23%, it is argued that these are significant enough to warrant attention from practitioners and performance researchers alike.

It is abundantly clear from the above results that the hypothesis that there is a relationship between organisational culture and construction project performance is supported by the empirical evidence. Whilst not all the dimensions of culture assessed are significant, and not all the measures of performance show an association with those significant dimensions of culture, there is significant evidence and support for the hypothesis that cultural orientation (along certain specific dimensions of culture) has an impact on some project performance outcomes. These findings have thus demonstrated that the culture within the CPO is a significant aspect that research into project performance must address in order to evolve comprehensive frameworks for performance improvement. These findings also provide justification for the calls for cultural change within the CPO.

This chapter has thus addressed the final two objectives of this research which sought to explore the possible relationships between each specific cultural attribute and the performance of the project organisations, and to develop models that relate organisational culture with performance – these objectives being linked to the main research hypothesis which posited that there is a significant relationship between the culture of the CPO and construction project performance.

Having established clear relationships between cultural orientations and performance outcomes of construction projects, the next phase of this research addresses the need to validate these findings, and the next chapter focuses on this aspect of the research.

CHAPTER 9: RESEARCH VALIDATION

9.0 INTRODUCTION

In the last three preceding chapters, the data collected has been analysed to address the hypotheses of this research, culminating in the development of models for the different performance outcomes. This has led to the identification of best practice cultural orientations that can facilitate the achievement of improved performance levels. Other inferences have also been drawn from the results. The extent to which the findings reported can be trusted however relies on the process of validation undertaken to confirm (or disconfirm) the findings of the research. This chapter is thus devoted to the description of the validation process that was undertaken in respect of this research.

9.1 THE RESEARCH PROCESS AND VALIDITY

For research in the social and behavioural sciences, validity is an important issue (Kerlinger and Lee, 2000). This is the case because often such research involves the invention of indirect means of measuring attributes for which there are no obvious empirical referents (physical or behavioural). This naturally brings up the question raised in Kerlinger and Lee (2000) of whether such measurements are indeed what the research set out to measure. This is what makes the issue of validity and validation of research important. There are various types of validation in the literature. It is common to come across face, content, criterion, construct, internal, statistical inference, and external validity (cf. Reason and Rowan, 1981; Babbie, 1990; Bagozzi *et al.*, 1991; Fellows and Liu, 1997; Kerlinger and Lee, 2000; Garson, 2007b). In line with Garson (2007b), some of these have already been addressed in the questionnaire development (e.g. using pilot study as a means of face and content validation) and the statistical analyses presented in the preceding chapters (e.g. factor analysis as a means of construct validation (Kerlinger and Lee, 2000)). In this chapter, the searchlight is thrown on the external and internal validation of the research which are yet to be addressed.

9.2 EXTERNAL VALIDATION

According to Brinberg and McGrath (1985), the essence of external validation is to gain confidence in the findings and what they mean. It is about ensuring the robustness of the research and about assessing its generalisability (Reason and Rowan, 1981; Rosenthal and Rosnow, 1991; Fellows and Liu, 1997). There are three aspects of research validation falling under the domain of external validation *viz*; replication, convergence analysis and boundary search. It is argued in Brinberg and McGrath (1985) that it is this process of validation that transforms research information into knowledge.

9.2.1 Replication

Replication involves determining whether the set of findings can be reproduced when the same pathway (experimental, theoretical or empirical) and the same set of instruments, research design, and research strategy are used again (Brinberg and McGrath, 1985; Rosenthal and Rosnow, 1991). In other words to what extent would the same findings occur if the study is repeated with no factors varied?

Other sources describe this as the test of reliability of the research (cf. Rosenthal and Rosnow, 1991; Hair *et al.*, 1998; Kerlinger and Lee, 2000). In reality, it is not possible to have an exact replication given that no two occasions are ever the same (Brinberg and McGrath, 1985; Rosenthal and Rosnow, 1991). For this research in particular, beyond the logistical constraints of repeating this survey, it was also unrealistic to expect that the same respondents would be willing to complete the same survey again, especially considering the comprehensiveness of the survey instrument (Appendix D). For these reasons it was not possible for this survey to be directly replicated. It must however be emphasised that the questionnaire was developed and piloted, to ensure that the data collected was reliable.

9.2.2 Convergence analysis

Brinberg and McGrath (1985) argue that the principle of convergence, also referred to as triangulation, is at the core of assessing the robustness of research. In principle, convergence analysis is about determining the broad range of conditions under which the findings will hold (i.e. the scope of the findings). Convergence is achieved only when there is agreement of substantive outcomes derived from the use of different and independent models, methods, and/or occasions (Brinberg and McGrath, 1985). In other words, unlike replication, some of the factors are consciously varied, the study is repeated and the results are assessed to see if they converge with the original findings. In this study, the hold-back sample was utilised in the first instance to fulfil this purpose. Here the factor varied was the sample. Some of the key results are presented below.

9.2.2.1 Analysis of the hold-back sample

The hold-back sample was compared with the main sample to assess whether or not the results were significantly different from each other, with evidence of significant differences implying that the findings of this research cannot be generalised. The analysis was based on ANOVA (nonparametric ANOVA where data was ordinal), and considered under the headings project characteristics, the culture of the CPOs, and performance outcomes.

Project characteristics

Figures 9.1 and 9.2 provide a comparison of the profile of projects in the hold-back sample and the profile of projects in the main sample. As can be seen from these figures, the profiles are fairly similar. Further comparisons (Figures 1 – 7, Appendix P) confirm this similarity.

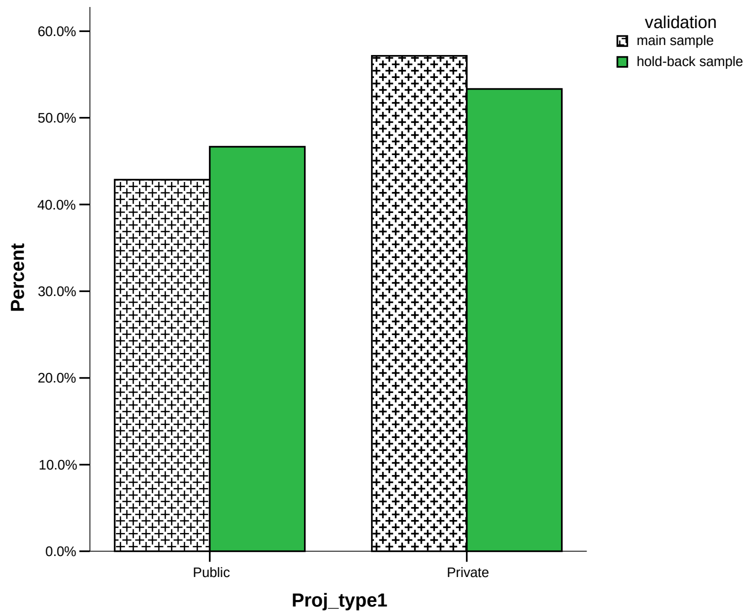

Figure 9.1 A comparison of projects by sectors

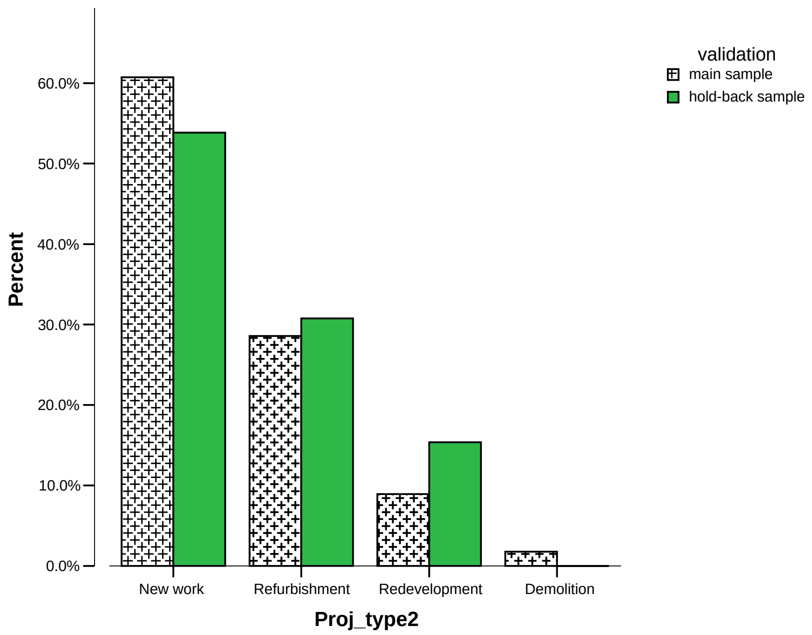

Figure 9.2 A comparison of projects by type of work

Table 9.1 also provides results of the test for significant differences based on the nonparametric ANOVA (Mann-Whitney test). Although the data comprised of both ordinal and scale data, the Mann-Whitney test was applied across all cases to provide a uniform measure for interpretation. It is evident from the Mann-Whitney statistics and the associated sig. values that statistically, there is no difference between the hold-back sample and the main sample in terms of the characteristics of the projects. This provides evidence that the research findings are valid and generaliseable.

Table 9.1 A comparison of different project characteristics

	Complexity	Contract price	Project duration	Prior_cost	Prior_time	Prior_qual	Prior_hands
Mann-Whitney U	612.000	645.500	529.500	660.000	632.000	670.500	595.500
Wilcoxon W	822.000	876.500	760.500	2740.000	863.000	2750.500	826.500
Z	-.313	-.270	-1.453	-.127	-.423	-.016	-.861
Asymp. Sig. (2-tailed)	.754	.787	.146	.899	.672	.987	.389

a. Grouping Variable: sample

The culture of the CPOs

Figure 9.3 provides a comparison of the cultural profile of projects in the hold-back sample and the profile of projects in the main sample. Here also it can be seen from the figure that the profiles are fairly similar.

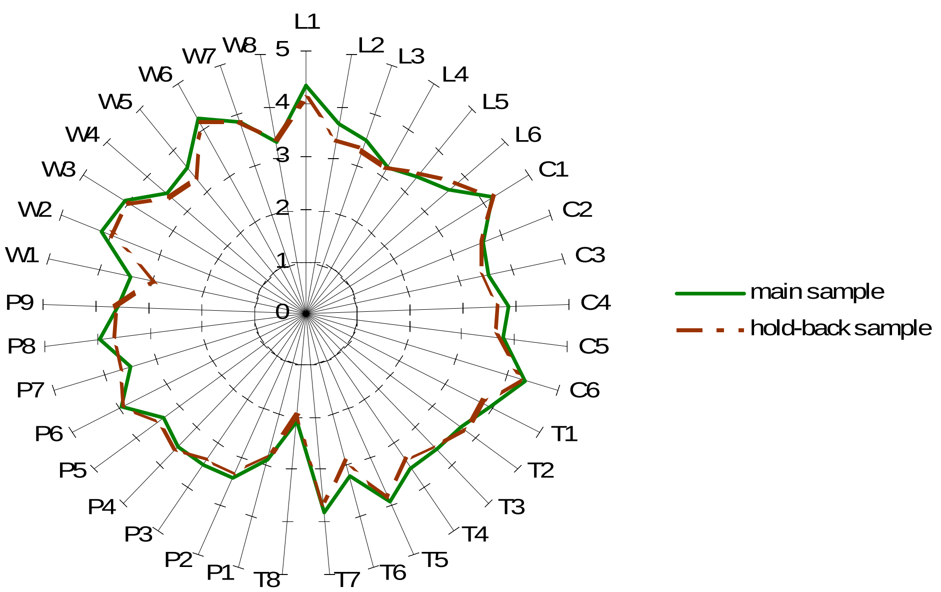

Figure 9.3 A comparison of the cultural profiles of the samples

To test whether any apparent differences are statistically significant, ANOVA was carried out on the two samples for all the 37 dimensions of culture. Results for 12 of these dimensions are shown in Table 9.2 below, with the results of the remaining 25 dimensions reproduced in Appendix P.

Table 9.2 A comparison of the cultural profiles of the samples: ANOVA results for L1 – C6

		Sum of Squares	df	Mean Square	F	Sig.
L1	Between Groups	1.097	1	1.097	2.677	.106
	Within Groups	34.025	83	.410		
	Total	35.122	84			
L2	Between Groups	1.768	1	1.768	4.205	.043
	Within Groups	34.897	83	.420		
	Total	36.665	84			
L3	Between Groups	.488	1	.488	.966	.329
	Within Groups	41.902	83	.505		
	Total	42.390	84			
L4	Between Groups	.029	1	.029	.059	.808
	Within Groups	40.299	83	.486		
	Total	40.327	84			
L5	Between Groups	.040	1	.040	.083	.775
	Within Groups	40.179	83	.484		
	Total	40.219	84			
L6	Between Groups	.370	1	.370	.747	.390
	Within Groups	41.097	83	.495		
	Total	41.467	84			
C1	Between Groups	.030	1	.030	.049	.826
	Within Groups	50.932	83	.614		
	Total	50.962	84			
C2	Between Groups	.017	1	.017	.023	.879
	Within Groups	59.019	83	.711		
	Total	59.035	84			
C3	Between Groups	.394	1	.394	.709	.402
	Within Groups	46.141	83	.556		
	Total	46.535	84			
C4	Between Groups	.754	1	.754	1.504	.224
	Within Groups	41.609	83	.501		
	Total	42.363	84			
C5	Between Groups	.247	1	.247	.503	.480
	Within Groups	40.764	83	.491		
	Total	41.011	84			
C6	Between Groups	.084	1	.084	.206	.651
	Within Groups	33.801	83	.407		
	Total	33.885	84			

As can be seen from Table 9.2 and Appendix P, only one dimension of culture i.e. supportiveness & appreciation (L2) with $F = 4.205$ and $p = 0.043$, showed some evidence of a difference between the hold-back sample and the main sample. Even here, the evidence was not strong. It can thus be inferred from these results that the findings are generally consistent across samples from the same population and are therefore generaliseable.

Performance outcomes

The performance outcomes of the two samples were also compared for evidence of significant differences. Because the performance measures were a combination of both ordinal and scale data, nonparametric ANOVA (Mann-Whitney test) was employed to provide a uniform test for all the performance measures. Results are shown in Table 9.3.

With the exception of learning outcomes (Learn) which showed some evidence (albeit not strong evidence) of a difference between the two samples ($z = 2.168$ and $p = 0.030$), none of the other variables were significantly different across the sample. Here also, it can be argued that this provides support for the validity and generaliseability of the research findings.

As can be observed from these results and further results reproduced in Appendix P, there is little evidence that the results from the hold-back data are different from the main sample. In other words, the hold-back data largely mirrors the results of the main sample. It can be concluded therefore that the findings reported in this thesis are to a large extent generaliseable across construction projects in the UK.

Table 9.3 A comparison of the performance outcomes of the two samples

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Cost Performance (%)	661.000	892.000	-.113	.910
Time Performance (%)	642.000	2722.000	-.319	.750
Defects	549.000	739.000	-.512	.608
Acc_rep	604.000	835.000	-.756	.450
Near_misses	640.000	2720.000	-.375	.707
Fatalities	672.000	903.000	.000	1.000
Injuries	581.500	2661.500	-1.014	.311
Prod	664.500	2744.500	-.082	.935
Absent	444.000	580.000	-.166	.868
Disp_client	610.500	2690.500	-.828	.407
Disp_others	568.000	799.000	-1.213	.225
Claims	652.500	2732.500	-.263	.793
Learn	464.000	695.000	-2.168	.030
Innov	568.500	799.500	-1.080	.280
Sat_serv	621.500	852.500	-.563	.574
Sat_cost	605.000	836.000	-.734	.463
Sat_time	600.000	2680.000	-.790	.430
Sat_qual	664.500	895.500	-.084	.933
Sat_fac	503.500	734.500	-1.849	.064
Sat_wages	582.000	2662.000	-.982	.326
Sat_prof	513.500	2593.500	-1.671	.095
Sat_harm	619.000	850.000	-.572	.567

a. Grouping Variable: validation

9.2.2.2 Analysis of qualitative feedback

It has been noted that every research strategy has its flaws. It has also been posited that it is only through the application of multiple strategies that the flaws can be offset and the uncertainties associated with the findings be reduced (Brinberg and McGrath, 1985; Rosenthal and Rosnow, 1991). In order to fulfil this requirement, and as a second phase to the search for convergence, another strategy was employed in this research involving the use of qualitative data. The relationships (or lack thereof) identified through the quantitative analysis were presented to experienced practitioners to provide their views on the extent to which such relationships between cultural orientation and performance actually exist on construction projects, based on their own experience of working in construction. With this approach, described in Silverman (1993) as respondent validation, it is argued that where participants verify the tentative results of the research, this generates more confidence in the validity of the findings. The procedure adopted from Bloor (1978, in Silverman, 1993) involved providing participants with a research report (Appendix Q) and recording their response to it. It has been argued that this process of going back to participants with tentative results and refining them in the light of participants' reactions is a characteristic of good research (Reason and Rowan, 1981). This approach has been used extensively in construction management research with Hari *et al.* (2005) for instance interviewing five experts to validate their research findings.

Five experienced construction industry practitioners accepted the invitation to share their views on the relationships found between the dimensions of culture and the measures of project performance. The mean number of years of experience of working in construction was 20½ years. This was an opportunity for them to challenge the relationships suggested and to propose alternative associations that they considered to be more accurate reflections of the construction project context. Their responses to the various questions are tabulated in Appendix R, and summarized below.

In response to whether from their own experiences of working on construction projects they found projects with higher participant satisfaction to be those with higher team and workforce orientations, all the respondents answered in the affirmative. To quote a respondent, this finding was:

> *"Absolutely true – people need to be engaged with the project."*

Another respondent expressed the view that whilst team and workforce orientations are both likely to influence satisfaction levels, team orientation is likely to be the more important factor. This is consistent with findings reported in Ankrah *et al.* (2007b).

In response to whether from their own experiences of working on construction projects they found projects with better H&S and quality outcomes to be those with higher project and team orientations, the majority of the respondents again answered in the affirmative.

In response also to the question of whether from their experiences of working on construction projects they found projects with higher levels of innovation and learning to be those with higher workforce orientation, the respondents were unanimous in affirming the validity of this finding. Clearly the data analysis has revealed a relationship with which practitioners identify.

In response to whether from their own experiences of working on construction projects they found projects with higher innovation and learning outcomes to be those with lower team orientation, two of the respondents agreed that this was indeed the case. A third respondent however found this outcome surprising stating that:

> *"One would have expected that innovation and learning would flourish on projects where there is a positive team environment."*

In trying to rationalise this finding, another respondent who felt that the findings were possibly valid suggested that:

> *"Sometimes rewards associated with innovation breeds competition among participants which detracts from teamwork."*

This view is consistent with Hartmann (2006). When asked whether the finding that none of the dimensions of culture were associated with time and cost outcomes was a valid reflection of what happens on a construction project, respondents were split. Whilst for some this outcome was not surprising, one particular respondent disagreed outright with this finding arguing that:

> *"I find that culture on a project changes and enthusiasm slips with delays."*

In relation to the lack of evidence to link client and performance orientations with any of the performance outcomes, the results were also mixed. Some scepticism was displayed by the respondents, with the general feeling summed up in the sentiment:

> "(The finding is valid) t*o some extent. For instance, some clients don't want to be involved and on such projects the level of client focus doesn't make any difference. On projects where clients are more hands-on, client focus is likely to have an influence on performance."*

One respondent however challenged the validity of this particular finding stating that it was "hard to believe".

It can be concluded from the above responses that although generally the respondents are affirming the findings of the questionnaire survey, the limitations of questionnaire surveys have also been made evident in the scepticism of some of the respondents in respect of some of the findings. A key limitation of questionnaire surveys is their inability to completely eliminate or expose the 'noise' or influence of extraneous factors, and also their inability to delve into issues beyond the superficial. It is possible that the scepticism was as a result of some of these limitations. This not withstanding, it is contended that overall, there is agreement between the views of the respondents and the questionnaire survey results.

The convergence or triangulation achieved by adopting this approach is evidence, as indicated in Brinberg and McGrath (1985), that some of the sources of potential invalidity in measurement and manipulation of variables were successfully reduced during the course of the research. It can be concluded from these results that generally the findings of the main survey are an accurate reflection of the situation within the construction industry, and to that extent, generalisations can be made for construction projects across the UK.

9.2.3 Boundary search

Boundary search is the third aspect of external validation. Also referred to as differentiation or discriminant validity, it is the attempt to identify the boundaries associated with the findings of a research (Brinberg and McGrath, 1985; Rosenthal and Rosnow, 1991). It has been noted that it is not typical to find researchers going beyond replication and convergence analysis to deliberately search for the boundaries of findings (Brinberg and McGrath, 1985). Whilst it was not a deliberate intention in this research to follow this trend, it was not possible to progress to the boundary search stage purely due to the constraints (such as the time and cost constraints associated with completing a PhD) associated with undertaking this research. It is however recognised that there are some potential boundaries to the findings reported in this research, an example of which is the country of study. Indeed, these potential boundaries represent potential areas for further study.

9.3 INTERNAL VALIDATION

In Rosenthal and Rosnow (1991), internal validity has been defined as the degree of validity of statements made about whether X causes Y – the primary concern being to rule out plausible rival hypotheses. Similar definitions are provided in Fellows and Liu (1997), and Garson (2007b). All these sources emphasise the importance of good research design for achieving good internal validity. However they fall short of identifying appropriate procedures for checking whether indeed good internal validity has been achieved. In seeking to evaluate the internal validity of this research therefore, the strategy implemented in Xiao (2002) and Proverbs (1998) was adopted. This strategy involves the search for convergence between the three aspects of:

- Research findings;
- Published research; and
- Academic validation.

The principle here is that if convergence is demonstrated, then arguments (about X and Y) made on the basis of the findings of this research are valid, indicating that good internal validity was achieved through the research design. This strategy is particularly useful as it provides an opportunity to weigh the findings of this study against other published studies examining the same issues, and to subject it to expert scrutiny. It should be emphasised at this point that the absence of convergence does not necessarily imply a lack of internal validity. Rather, it may well be a sign of new insight.

9.3.1 Convergence of research findings and published research

It is believed that the outcome of a single study by itself contributes little to the body of knowledge. Only when the results of a single study have been compared with other studies that examine the same focal problem is the knowledge about the problem increased (Brinberg and McGrath, 1985). It has been shown in the preceding chapter that in the main, the findings are supported by the literature. These are summarised here again to emphasise the convergence between the research findings and the research literature.

9.3.1.1 The participant satisfaction model

The participant satisfaction model indicated that higher levels of team orientation would lead to higher levels of participant satisfaction. This finding is supported by independent research in the literature.

A quantitative study undertaken by Leung *et al.* (2004) on project participants found team-related variables in the form of team conflict, cooperation and participation, and goal commitment to be critical factors influencing the final satisfaction outcomes of construction projects. This finding is reinforced in Leung *et al.* (2005). Zuo and Zillante (2006) also found integration, cooperation and people orientation as the main contributors to project team satisfaction. Although focusing on customer satisfaction, studies like Maloney (2003) have also identified labour-management cooperation as a requirement for satisfaction. These publications corroborate the findings of this research.

9.3.1.2 The H&S and quality outcomes model

The H&S and quality model indicated that higher levels of project orientation and team orientation would lead to improved levels of H&S and quality outcomes. For this finding also, there is support in the literature.

Thomas *et al.* (2002) for instance found teamwork to be an essential determinant of quality outcomes. It was also found in this research that projects that under-performed were the "adversarial, conflict-ridden projects concerned with individual, or organisational self-preservation" (Thomas *et al.*, 2002) – in other words projects with an absence of team and project orientation. In an analysis of 120 questionnaires, Sawacha *et al.* (1999) identified *inter alia* worker-management relationship and management-worker cooperation on safety (aspects of team orientation) as important factors influencing safety performance. Control on sub-contract's safety behaviour and site tidiness were also identified in Sawacha *et al.* (*ibid*), and as argued in Chapter 8, these issues can be located within project orientation.

9.3.1.3 The innovation and learning model

The innovation and learning model indicated that as workforce orientation improves CPOs exhibit greater levels of innovation and learning, and as team orientation improves, CPOs exhibit lower levels of innovation and learning.

It has been suggested in Kululanga *et al.* (2001) that a climate of openness, rewarding innovations, leadership commitment to learning, a common sense of direction, and encouragement of employees to update their values (all fundamental aspects of workforce orientation) are essential for learning to take place. This corroborates the research findings. Conversely, the suggestion that higher levels of team orientation are associated with lower levels of innovation and learning is not supported by the literature (cf. Kululanga *et al.*, 2001). It also appears to be contrary to logical thinking. This does not necessarily invalidate the research and its findings. Indeed it may be that this research is shedding new insight on innovation and learning not previously captured. Whilst this is debatable, what cannot be doubted is the need for further research in this domain. As noted by an interviewee in the convergence analysis subsection above, there could be logical reasons for this finding such as the recognition and reward structure.

9.3.1.4 The time and cost model

The inability to develop a time and cost model indicated that cultural orientations are not very useful predictors of time and cost outcomes. This finding is also corroborated indirectly by the research literature on factors influencing time and cost outcomes (cf. Kaming *et al.*, 1997; Kog *et al.*, 1999) which are in the main silent on such 'soft' factors as those examined in this research, instead identifying such 'hard' factors as design changes, labour productivity, inadequate planning, resource shortages, inflation, errors in taking-off, project complexity, time devoted by project manager, frequency of meetings, monetary incentives to designer, implementation of constructability programme, and project manager's experience on similar projects, as the more critical determinants of time and cost outcomes of a construction project.

9.3.2 Convergence of research findings and academic validation

The process of disseminating the findings of this research to practitioners and the wider academic community through the publication of articles in international academic journals and conference proceedings involved a review and assessment of the validity of the research and its findings by independent referees. As noted in Xiao (2002) peer review in this manner provides an opportunity for the methodologies, meanings and interpretation of the research to be questioned. It is a process of critical inquiry which is meant in theory to provide an informed, fair, reasonable and professional opinion about the merits of research work (Runeson and Loosemore, 1999). Fenn (1997) has observed that peer review is used as the gold-standard throughout academia in the UK. Feedback from such a process serves to enrich research work and potentially improves its findings (Alkass *et al.*, 1998). During this review process, the article is sent anonymously to two – four independent experts in areas related to the particular subject of the paper (Xiao, 2002). The essence of anonymity (*ibid*) is to ensure that possible biases or prejudice in the review are eliminated, although in reality this is not always achieved (Runeson and Loosemore, 1999). There are four possible outcomes of this review. These are (i) acceptance without change; (ii) acceptance subject to minor changes; (iii) acceptance with major amendments; or (iv) rejection (Runeson and Loosemore, 1999). In all cases the referees provide feedback outlining the basis of their decision, often raising issues which range from trivial to fundamental which can be incorporated in the research to improve its validity.

During the course of this research, seven (7) conference papers have been developed and published (or are about to be). These papers have been presented at the annual international conferences of the Association of Researchers in Construction Management (ARCOM) (2004, 2005 & 2007), the Construction Industry Board (CIB) W92/T23/W107 International Symposium on Procurement Systems (2005), the biennial Postgraduate Researchers of the Built Environment (PRoBE) Conference (2005), and the Construction Management and Economics 25th Anniversary Conference (2007). A further three (3) journal papers have also been published or are in the review process. The journals targeted with these papers include Construction Management and Economics, Engineering Construction and Architectural Management, and the International Journal of Construction Management. These outlets were specifically targeted for their rigorous peer review procedures.

With the continual challenge and feedback from the academic community which have been incorporated in the research and into this thesis, the research has been improved significantly making the findings more robust and reliable as argued by Xiao (2002). Acceptance of the articles for publication indicates that this research is scholarly and academically valid. Thus it can be argued that there is convergence between the research findings and academic validation.

9.3.3 Convergence of published research and academic validation

An important characteristic of the publications described in the preceding sub-section is that most of the key arguments and findings of the research reported were supported by comprehensive literature. Even where divergent findings were reported, these were considered in the light of the extensive literature supporting the alternative views. As shown in Table 9.4, a total of 474 references have been cited giving an average of approximately 47 references per paper. Although some of these references are duplicated due to the similarity of the research context, there were also many distinct and paper-specific references used to support the specific findings reported in each paper. Following the precedent of Proverbs (1998), it is argued that the acceptance of these papers for publication (and by extension, the acceptance of the cited references) demonstrates the convergence of published research and academic validation.

Table 9.4 References cited in journal and conference papers

No.	Authorship	Year	No. of references cited
1	Ankrah and Proverbs	2004	44
2	Ankrah and Langford	2005	49
3	Ankrah and Proverbs	2005	39
4	Ankrah *et al.*	2005a	40
5	Ankrah *et al.*	2005b	47
6	Ankrah *et al.*	2005c	52
7	Ankrah *et al.*	2007a	38
8	Ankrah *et al.*	2007b	45
9	Ankrah *et al.*	2007c	51
10	Ankrah *et al.*	2007d	69
		Total	474
		Average	47.4

9.4 SUMMARY

This chapter has presented efforts to validate the findings of this research within the areas of external and internal validation. In the external validation, the hold-back sample comprising 21 independent projects was analysed and its results compared with the results from the main analysis. Generally, the results from the hold-back sample were consistent with the results from the main analysis implying that the findings reported are valid and can be generalised across construction projects in the UK. Moreover, when respondents were invited to share their opinions on these findings, they generally concurred with the findings even though in a few specific instances they expressed scepticism. Even where there was scepticism, this was not unanimous and therefore does not invalidate the findings.

The internal validation sought convergence of the research findings, published research and academic validation. It is argued that the relationships between culture and performance uncovered in the analysis are largely supported by the literature. Ten (10) papers have been developed and published (or are under review) in various peer reviewed academic journals and conference proceedings. In all these papers, a significant number of references have been cited to support the arguments advanced in these papers. It is thus argued that this research is convergent with the established knowledge.

In the next chapter, the conclusions of this research based on the analyses and validation efforts will be set out. The limitations of the research and recommendations will also be put forward.

CHAPTER 10: CONCLUSIONS AND RECOMMENDATIONS

10.0 INTRODUCTION

Improvement in project performance has been a recurring theme in all the major construction industry reports. For this improvement in project performance to be realised, it is essential to investigate systematically, factors such as the culture within the project organisation that are widely believed to have an impact on project performance outcomes. To this end, this research has undertaken a study of construction projects in the UK with the aim being to diagnose the culture within the CPO and assess its impact on project performance outcomes. This has led to the development of a number of 'best practice' culture-performance models. After summarising the entire research, this final chapter outlines the main findings and the limitations of the research. It also offers some recommendations for construction industry practitioners, and some recommendations for future research.

10.1 SUMMARY OF THE RESEARCH

In the first chapter of this thesis, the aim of this research was set out as being to determine empirically the extent to which organisational culture influences construction project performance and the nature of this influence, and to develop a model that will assist CPOs to assess, in terms of performance, the possible outcomes of their cultural orientation. To help achieve this end, a number of objectives were put forward. The summary presented here outlines how these objectives were achieved.

10.1.1 The UK construction industry and the performance deficit

The first objective, addressed in Chapter 2, required an examination of the UK construction industry and its performance. The construction industry is responsible for the delivery of the UK's built environment, in all its various forms. It delivers this built environment through projects, with a number of organisations coming together to form a temporary project organisation that undertakes the construction. Unfortunately, the industry has consistently failed to deliver these projects to the specified requirements. This state of affairs has inspired a significant amount of research into project performance and factors influencing performance outcomes. Whilst several of the factors identified in the literature are 'soft' factors which stem from the culture that exists within the CPO, few direct references to organisational culture are made in the performance literature. Even where references to organisational culture are made in the performance literature, the extent of its impact are not set out. This situation inevitably implies a difficulty in assessing the effects of the cultural orientation of the CPO on performance, and the likely performance outcomes of cultural change. This shows that there is a gap in the knowledge on cultural orientation and performance that needs to be explored.

10.1.2 The importance of culture

The second objective addressed in Chapter 3, required an exploration of the phenomenon of culture and the relevant theories. The consensus of views, established through the review of culture, suggested that culture comprises the values and system of meanings peculiar to a group of people, that are learned and shared by all the individuals in the group through dealing with the basic problems of life and through their interaction with the contextual factors relating to the environment in which they live. Culture therefore has the ability to shape the behaviour of, not just individuals, but groups of people as in organisations, industries and countries. This innate ability of culture to shape behaviour has particular relevance for the construction industry because of the industry's peculiar nature of contracting and product delivery, requiring the cooperation of a myriad of participants who sometimes have different and conflicting objectives. Unfortunately, for a long time, the importance of culture has been understated and references to its influence have been mainly anecdotal, with little by way of systematic research to show the extent of its impact.

This trend has been changing over the past decade. Growing awareness of the importance of culture in construction has seen increasing research interest and publications on culture and related issues, though much of this still remains anecdotal. The review demonstrated that fundamental questions of what the cultures of CPOs are and what impacts these cultures have on performance outcomes are yet to be investigated. It is argued that construction industry participants need to become more aware of the importance of this phenomenon and its manifestation and impact on the process and product of construction business. This can only be achieved through systematic research.

10.1.3 A conceptual model of culture and performance

For research to be undertaken, it is necessary to have appropriate frameworks based on improvement and adaptation of existing frameworks (Tijhuis, 2001). The third objective was therefore to develop such a framework and this was addressed in Chapter 4. On the basis of the literature review, a conceptual model was developed showing the contextual variables that are instrumental in determining the organisational culture of CPOs that develops, the relevant dimensions along which the culture of the CPO manifests, and how these dimensions of culture subsequently influence project performance outcomes.

On the basis of the conceptual model, three fundamental hypotheses were proposed for testing. These hypotheses related to a difference (or lack of it) in cultural orientation among different CPOs, a difference (or lack of it) in performance levels of the different construction projects, and a relationship (or lack of it) between the cultural orientations of CPOs and the project performance outcomes. The next phase of the research involved the testing of this conceptual framework.

10.1.4 A methodology for investigating culture and performance

Chapter 5 considered the overall research paradigm within which the relationships highlighted in the conceptual model were to be investigated, and the research methods appropriate within this paradigm. This chapter set out arguments in favour of a conciliatory methodology involving both a qualitative and a quantitative methodology. In terms of the specific research methods for data collection, interviews and questionnaire surveys were adopted following the precedent of Hofstede *et al.* (1990).

A series of semi-structured interviews were conducted with highly experienced construction industry participants in line with the proposed methodology. The data collected reinforced the fundamental relationships conceptualised in the model. The model thus provided an appropriate basis for the development of the questionnaire. The questionnaire was designed to capture project characteristics, measure cultural orientation and measure performance. It was argued, in line with Bandura's social cognitive theory, that the measurement of culture should address attitudes and perceptions, goal-directed behaviour, and situational conditions associated with the various dimensions of culture (Cooper, 2000). It was also argued, in line with Takim *et al.* (2003), that the measures of performance assessed should be measures associated with the goals and objectives related to the dimensions of culture. These considerations were incorporated in the questionnaire design. Within culture research in construction, this approach represents a significant departure from the norm and is novel in its application of both qualitative and quantitative methodologies, and in its application of social cognitive theory.

Following a successful pilot of the questionnaire, minor modifications were made to the questionnaire based on the feedback, and the major survey was conducted on a randomly selected sample of contractors listed in the UK Kompass (2006) register. Altogether, 85 sets of data were generated representing an overall response rate of 15.42%.

10.1.5 An analysis of project characteristics and the cultural orientations of the CPOs

In Chapter 6, analysis of the data collected was undertaken to address the first part of the fifth objective. In this chapter, descriptive statistics, chi-square tests and Freidman's test were utilised to provide a picture of the projects captured in the questionnaire survey. Principal component factor analysis and cluster analysis were then utilised alongside descriptive statistics to analyse the cultural orientations of the CPOs. Then the Mann-Whitney test, Kruskal-Wallis test, and non-parametric correlation analysis were employed to explore and draw inferences about the relationships between the project parameters and the cultural orientations of the CPOs within the sample. The results indicated that the sample was generally representative of construction projects in the UK. Projects of all kinds reflecting the range of projects that contractors undertake from simple jobbing projects to very complex multi-million pound projects, procured under different arrangements, and across all regions of the UK were represented. Not surprisingly, the Main Contractor was reported as the most influential participant overall. Of significance was the fact that overall, the performance ethos of CPOs was in the order H&S–

quality–cost–time, with H&S as the most important and time as the least important.

Application of principal component factor analysis to the attributes of culture assessed in the survey led to the extraction of five principal dimensions of *workforce orientation, performance orientation, team orientation, client orientation* and *project orientation*. Based on these five dimensions, it was found that the CPOs can be grouped into five clusters which are significantly different along workforce, team, client and project orientations. This provides confirmation that CPOs do indeed have different cultures. This finding provides support for the hypothesis H_1 (refer Chapter 4) which posits that there are significant differences in the organisational cultures of CPOs working on different construction projects in the UK.

Analyses carried out to assess differences in cultural orientations attributable to project parameters revealed that not all the contextual factors have an effect on the culture of the CPO. However, there is evidence that some of the factors do have an effect on the cultural outcomes. In particular, project size, complexity, the influence of participants like the quantity surveyor, client and the main contractor, the level of importance of cost and H&S, location, and the number of design variations showed some evidence of association with some of the dimensions of culture.

It is argued in this chapter that there is still some scope for strengthening the orientations of the CPOs along all the five dimensions of culture. However whether or not it is necessary to devote resources to any effort to improve cultural orientations depends on research demonstrating that such improvements will lead to better performance outcomes.

10.1.6 An appraisal of project performance

In order to provide a basis for the evaluation of the impact of cultural orientations on project performance outcomes, there was a need to assess the performance of construction projects in the UK. This was the second part of the fifth objective, and was addressed in Chapter 7. A variety of performance measures including *inter alia* cost, time, quality, health and safety, disputes, and productivity outcomes were assessed.

Generally, the performance levels found in this research were consistent with other reports and surveys carried out (cf. CCF/CBPP, 1999; Constructing Excellence, 2006; Kashiwagi *et al.*, 2006), with the evidence suggesting that there have been some improvements in the overall performance levels across the construction industry. Several measures of performance were assessed in this research. However, the application of principal component factor analysis led to the extraction of four principal measures of performance *viz*; *satisfaction of participants*, *H&S and quality*, *innovation and learning*, and *time and cost outcomes*. When analysed across the project parameters, it was found that whilst overall performance (the aggregation of the four performance measures) did not vary significantly for different project types, satisfaction of participants, H&S and quality, innovation and learning, and time and cost outcomes did vary significantly from project to project. This finding thus provides support for the hypothesis H_2 (refer Chapter 4) which posits that there are significant differences in the performance levels of different projects across the UK.

10.1.7 The relationship between culture and project performance

Having established clear differences in cultural orientation and performance levels of construction projects, the next phase of this research focused on the examination of the data for evidence of relationships between cultural orientations and performance outcomes. This was presented in Chapter 8 and addressed the final two objectives of this research. Pearson's correlation coefficients and stepwise multiple regression were employed in the analysis.

It was found that significant associations exist between participant satisfaction and workforce and team orientation. Projects with higher participant satisfaction were generally those with the higher workforce and team orientations. Significant associations were also found to exist between H&S and quality outcomes and project and team orientation. Projects with better H&S and quality outcomes were generally those with higher project and team orientations. Significant associations were also found between innovation and learning and workforce and team orientations. Projects with higher innovation and learning were generally those with higher workforce orientation, but lower team orientation. Finally for the overall performance index developed, significant associations were found with workforce and project orientations. Projects with better overall performance were those with higher workforce and project orientations. Although these relationships were found to be associated with relatively small R^2 values ranging from 12% to 23%, it is argued that these are significant enough to warrant attention from practitioners and performance researchers alike.

The significant associations established through this analysis thus provides empirical support for the main research hypothesis H_3 (refer Chapter 4) which posits that there is a significant relationship between organisational culture and construction project performance.

10.1.8 Validation of the research

Chapter 9 presented the validation of the findings of this research within the domains of external and internal validation. In the external validation, the hold-back sample comprising 21 independent projects was analysed and results were compared with those from the main analysis. Generally, the results from the hold-back sample were consistent with the results from the main analysis implying that the findings reported are valid and can be generalised across construction projects in the UK. Moreover, when experienced practitioners were invited to share their opinions on these findings, they generally concurred with the findings even though in a few specific instances they expressed scepticism. Even where there was scepticism, this was not unanimous and therefore not considered enough to invalidate the findings. What this does suggest however is that there is still some scope for deeper insight within this domain.

The internal validation sought convergence of the research findings, published research and academic validation. It was shown that the relationships between culture and performance uncovered in the analysis are generally supported by the literature. Ten (10) papers have been developed and published (or are under review) in various peer reviewed academic journals and conference proceedings. In all these papers, a significant number of references have been cited to support the arguments advanced in these papers. It was thus argued that this research is convergent with the established knowledge and can therefore be considered as valid.

10.2 CONCLUSIONS OF THE RESEARCH

The main conclusions drawn from the research are that:

- There are five principal dimensions of culture, namely workforce orientation, performance orientation, team orientation, client orientation and project orientation along which the culture of a CPO can be diagnosed.
- CPOs in the UK do indeed have different cultures which are significantly different particularly along workforce, team, client and

project orientations. Different CPOs can therefore be distinguished from each other along these dimensions. This finding provides support for the hypothesis H_1 which posits that there are significant differences in the cultures of CPOs working on different construction projects in the UK.

- The culture of the CPO along the five principal dimensions varies with key project features, in particular project size, complexity, the influence of participants like the quantity surveyor, client and the main contractor, the level of importance of cost and H&S, location, and the number of design variations. In terms of these features, all construction projects have different configurations implying that different cultural orientations are likely to exist. At the very least, project participants need to be aware of such possibilities. Whilst the project organisation has little control over some of these project features, the insight into the cultural consequences of undertaking projects with particular features provides an opportunity for project participants to take these into account when planning towards projects and take steps to mitigate any undesirable cultural outcomes. Significantly, it was found that the procurement route did not make any difference in the culture. Clearly, it should not be taken for granted that adopting partnering for instance as a procurement framework would automatically result in a different cultural orientation. Participants need to work at developing the desired culture.
- Project performance levels are consistent with other reports and surveys carried out, with the evidence suggesting that although there have been some marginal improvements in the overall performance levels across the construction industry, there is still some scope for further improvement. There are also significant differences in performance levels across different construction projects in the UK providing support for the hypothesis H_2. All measures of project performance (at least those assessed in this research) can be subsumed

under the four principal measures of participant satisfaction, H&S and quality outcomes, innovation and learning, and time and cost outcomes.

- Whilst not all the dimensions of culture assessed are significant in terms of their association with the performance measures, and not all the measures of performance show an association with those significant dimensions of culture, there is significant evidence and support for the position that cultural orientation (along certain specific dimensions of culture) has an impact on some project performance outcomes. The significant associations found provide empirical support for the main research hypothesis H_3 which posits that there is a significant relationship between organisational culture and construction project performance.

In summary, culture matters. The calls for cultural change in the project organisation are therefore justified. Research into project performance must therefore also consider this aspect in order to evolve comprehensive frameworks for performance improvement.

10.3 CONTRIBUTION TO KNOWLEDGE

Building on the existing knowledge on organisational culture, this research has provided greater insight into organisational culture within a construction project context, in particular providing empirical evidence that different CPOs have different cultural orientations and that these different cultural orientations are associated with different levels of performance. It has also demonstrated that workforce, team and project orientations are the specific dimensions of culture which have the most significant association with project performance outcomes and as such are the dimensions that require the attention and resources of the organisations involved in the project. This is not to suggest that the other dimensions i.e. performance and client orientation are unimportant, but rather that the research did not uncover evidence to establish their degree of importance. Four (4) statistical models have been developed to represent the relationships between the cultural orientations and performance outcomes, and though their predictive utility is limited, these models do provide some guidance on the likely project performance outcomes given specific cultural orientations. This implies that early on during the construction process, CPOs can undertake an assessment of their cultural orientation and based on that, forecast the probable project performance. Where necessary, action can be taken to manage or even change the cultural orientation in terms of the attitudes and behaviours of participants, as well as the situational context.

By empirically associating various cultural orientations with project performance outcomes, this research has provided some evidence that culture does matter in the quest for performance improvement on construction projects. The findings can thus be used as a basis for recommending or encouraging cultural change within project organisations. It can also be used as a basis for encouraging researchers of project performance to devote more attention to the 'softer' aspects such as culture in order to evolve more comprehensive frameworks for performance improvement.

Beyond the direct output of the research discussed above, the research has also made significant contribution by moving the discussion of organisational culture within the construction research context from the traditional 'black box' approach towards more empirically grounded discourse. It has also demonstrated that beyond the existing generic organisational behaviour frameworks, it is possible to develop reliable construction-specific frameworks that can be employed successfully in research and yield meaningful outcomes. Indeed the framework developed in this research is itself unique to this research, and coupled with the application of social cognitive theory for the measurement of culture, also represents a contribution that can be adopted by other researchers for application in further research.

As a result of the research undertaken, ten (10) technical papers have been published (or will soon be) in refereed international construction journals and conference proceedings. Full bibliographic details are provided in Appendix A. Several more are under development.

10.4 A REFLECTION ON THE RESEARCH

This research has achieved its aim of providing a general overview of the culture of CPOs and exposing some of the significant associations between the culture of the CPO and construction project performance outcomes which may be indicative of a causal effect of culture, even though an actual effect has not been established in this research. In undertaking this study, a number of choices have been made which have ultimately influenced the methodology adopted, data collected, analysis undertaken and consequently, the findings. Whilst these choices have facilitated the achievement of the objectives of this research, they have also imposed some constraints on the research. For instance as shown from the literature review section (refer Chapter 3), studies of culture attempt to answer a number of key questions about a group of people typically in relation to *what*, *why* and *how* a way of doing things or responding to problems has developed. To address the objectives of this research, the choice was made to focus on the question relating to *what* way of doing things has developed on construction projects. This choice is amenable to a quantitative approach which was thus adopted for this study. By making this choice, the study was as a result limited to a superficial examination of the culture within the CPO. Although this was adequate for the purpose of achieving the research objectives, it failed to allow the deeper insight into the underlying assumptions and beliefs which for some researchers (cf. Schein, 1985) is the very essence of culture. Compounding this limitation was the number of dimensions of culture addressed in this study which further precluded an in-depth examination of any particular dimension of culture. To derive the maximum benefit from a study into a phenomenon like culture, perhaps a more appropriate approach for future research may be to focus on only one dimension of culture, asking all the *what*, *why* and *how* questions to unearth the underlying assumptions and beliefs of the project participants. This approach is more suited to a qualitative methodology and will address a different set of objectives.

Within the main quantitative phase of the study, data on construction projects was collected by means of a questionnaire survey of knowledgeable informants. The use of a single informant in each case is supported by the literature (cf. Ogbonna and Harris, 2000; Anderson, 2003). However it raises questions of whether their perceptions are consistent with the perceptions of other participants of the project, especially considering the multi-organisational nature of the CPO. Research of this nature on culture will benefit from the perceptions of a cross-section of project participants and therefore if possible, researchers should endeavour to collect such data. Again as indicated in Chapter 5, 85 sets of data were generated corresponding with a 10.63% margin of error. Whilst this was adequate for the purposes of inferential statistics, a bigger sample size would be necessary in future research to draw firmer conclusions about the results in terms of the existence of a cause and effect relationship between the dimensions of culture and performance outcomes, especially with the application of factor analysis as one of the techniques for statistical analysis.

From the above discussions, it can be seen that whilst the research undertaken has addressed the objectives set out, and has explored a range of techniques suitable for analysing cultural orientations and drawing inferences about the relationships between these orientations and performance which can be applied in other similar studies, there is still some potential for improving such studies to provide deeper insight into culture within CPOs.

10.5 LIMITATIONS

Beyond those highlighted in the preceding section, there are some other potential limitations that should be borne in mind when interpreting the findings of this research. It has been noted in Babbie (1992) that theoretical concepts almost never have perfect indicators. Any given concept has several possible indicators and whilst theory and empirical evidence facilitate the identification of the most useful indicators, they do not give any guarantees that these indicators are indeed the best. In this research, a number of indicators have been utilised as proxies for the measurement of both culture and performance, and as noted above they may not be perfect indicators. Moreover, every empirical indicator has some defects (Babbie, 1992). Although this is a potential limitation it is also important to emphasise that significant theoretical and empirical evidence were adduced to support the choice of these indicators. Again it was impossible to ascertain whether or not all the respondents answered the questions with candour. Thus as recognised in Hammond (2006), if the respondents failed to answer the questions honestly and to the best of their recollection as envisaged, then the results may not be a true reflection of the population. However, the application of multiple research methods helped to obviate the potential biases.

Given that the focus of the empirical aspects of this research was entirely on the UK, and given the macro-cultural influences implied in the thesis, it is entirely plausible that there may be significant differences in the findings if this study is replicated in another jurisdiction. Indeed this aspect is recommended as a potential area for further research.

The limitations noted here do not however undermine the validity of the research undertaken and its main findings. It should be remembered that scientific research is a never-ending quest aimed at the understanding of some phenomenon which requires continuous measurement and examination of associations (Babbie, 1992), and this research is just one step on this quest.

10.6 RECOMMENDATIONS FOR INDUSTRY

As observed earlier, one of the most important tasks of the Project Manager (and indeed all key stakeholders) is to ensure that the optimum project culture is developed (Riley and Clare-Brown, 2001). Within the limitations outlined above, this research has provided some direction on what an optimum project culture ought to be, and some indication of aspects where there is potential for improvement in industry. A number of recommendations can thus be put forward to provide some direction for improvement in this regard as follows:

- To improve the likelihood of achieving greater participant satisfaction, greater innovation and learning, and better overall performance, it is recommended that practitioners devote more effort and resources towards making their CPOs more workforce oriented. In practical terms this means putting more effort into motivating the workforce, emphasising teamwork, promoting free and open communication on site, emphasising site tidiness, recognising good performance, keeping operatives informed of project developments, encouraging greater workforce participation in planning and decision-making, and encouraging communication between managers and operatives.
- To improve the likelihood of achieving better H&S and quality outcomes, and better overall performance, it is recommended that practitioners devote more effort and resources towards making their

CPOs more project oriented. In practical terms this means trying to foster a greater sense of identification with the project among participants, initiating measures to help align subcontractors' goals with project goals, and putting more emphasis on waste elimination.

- To improve the likelihood of achieving greater participant satisfaction, and better H&S and quality outcomes, it is recommended that practitioners devote more effort and resources towards making their CPOs more team oriented. In practical terms a greater team orientation means avoiding finger-pointing, promoting a greater level of management accessibility and approachability, free sharing of information, and trust. It is also recommended that for innovation and learning to flourish without compromising the team orientation, perhaps the industry must begin to recognise and educate participants that mistakes are acceptable, and encourage participants to resolve from the outset of the project the issues concerning leadership, who owns the benefits, and who bears the risk for things going wrong in the attempts to foster innovation and learning.

In summary, culture matters. As construction organisations strive for improved performance outcomes, it is recommended that construction industry practitioners who are the beneficiaries of improvements in performance devote more attention and resources towards cultivating the right culture within their project organisations. These issues go to the heart of participant's commitment to the project and their motivation towards achieving the project objectives. Some of the practical mechanisms that can be employed in this regards are induction of new participants, providing on-going training, offering a vision that all participants identify with, continuous monitoring, providing performance feedback, establishing appropriate reward structures that target team achievements, and ensuring stability by for example retaining a competent but limited pool of subcontractors.

10.7 RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the findings of the research and the limitations that have been noted, a number of recommendations are put forward to provide some direction for future research endeavour in this domain as follows:

- This research has revealed a number of significant associations between the dimensions of culture and the project performance outcomes that might be indicative of a causal effect of culture, although causality has not actually been established. To confirm and further validate these associations, future research in this genre must endeavour to collect data from a bigger sample to increase the precision of the analysis and to enable firmer conclusions to be drawn from the models.
- By addressing several dimensions of culture, this research was unable to delve into the details of any particular dimension of culture to unearth issues relating to the *how* and *why* particular orientations arise. For some researchers (cf. Schein 1985) this is the very essence of culture. A key recommendation therefore is that for future research in this domain, rather that addressing several dimensions of culture superficially, researchers must identify a specific dimension of culture and investigate this to great depth to unearth the underlying assumptions and beliefs that inform a particular orientation. Indeed, the exploratory research presented in this thesis provides some indication of the dimensions of culture that matter (i.e. workforce, team and project orientations) and could in the first instance be the focus of such in-depth research. Inductive ethnographic approaches are preferable for this sort of research, and will enable cause and effect relationships to be established more clearly.

- It has been found in this research that an increase in the level of subcontracting is associated with a decline in H&S performance, corroborating a finding in Sawacha *et al*. (1999) that subcontractor's safety behaviour is one of the factors influencing safety performance on construction sites. Unfortunately beyond pointing out the association between subcontracting and poor H&S, these studies do not go further to inquire into the underlying causes of this relationship and how it can be mitigated. With H&S becoming the most important objective on construction projects, it is recommended that further research be undertaken to delve deeper into the role of subcontracting practice in undermining efforts to improve H&S performance. Given that subcontracting is an inevitable part of construction, such research will represent a significant contribution to knowledge.

- Another significant but somewhat curious finding in this research was the evidence pointing to the negative association between the level of team orientation and the level of innovation and learning on the construction project. The scepticism expressed by experienced practitioners in relation to this finding suggests that there is a need also for further research to delve into issues of team orientation and the level of innovation and learning on a construction project to ascertain the validity and generalisability of this finding. If found to be valid, such a study will provide insight into those factors that account for this relationship, and steps that can be taken to ensure that innovation and learning is not at the expense of team orientation.

- As indicated in section 10.5, the research context was limited to construction projects in the UK. It is entirely plausible that there may be significant differences in the findings if this study is replicated in other countries. It will be interesting and useful for benchmarking purposes to find out if differences do exist and the effects (if any) on project outcomes. It is therefore recommended that this study is replicated in other countries to allow for comparative analysis to be undertaken.

- Potentially, the models presented in this research can be further developed to provide an early warning project management toolkit, possibly web-based, that will rely on a diagnosis of the culture within the CPO to forecast performance outcomes. However this will require further data collection to test and improve the rigour of the models.

10.8 SUMMARY

In summary, this research has explored empirically, the cultural orientations of CPOs and has found specific dimensions of culture that are associated with project performance. The conclusion that can be drawn from this is that culture matters, and cannot be taken for granted. Research into project performance must therefore also consider this aspect in order to evolve comprehensive frameworks for performance improvement. Again, beyond providing justification for the calls for cultural change in the project organisation, this research has also identified the direction of such change, and some of the drivers that need to be considered in trying to bring about such change.

REFERENCES

ABEYSEKERA, V. (2002) Understanding "Culture" in an International Construction Context, IN FELLOWS, R. & SEYMOUR, D. E. (eds.), *Perspectives on culture in construction, CIB report*, Vol. **275**, 39-51.

ABU BAKAR, R. (1998) The management practices and organisational culture of large Malaysian construction contractors, *Unpublished PhD thesis*, University of Reading, Reading.

AHADZIE, D. K., PROVERBS, D. G. & OLOMOLAIYE, P. (2005) Construction Performance Measurement Systems: Emerging Research Needs, IN RUDDOCK, L., AMARATUNGA, D., AOUAD, G., HAIGH, R., KAGIOGLOU, M. & SEXTON, M. (Eds.) *Fifth International Postgraduate Research Conference.* University of Salford, BUHU, 736-746.

AHADZIE, D. K., PROVERBS, D. G., OLOMOLAIYE, P. & GAMESON, R. (2006) A conceptual predictive model for evaluating the performance of project managers in mass house building projects, IN BALDWIN, A., HUI, E. & WONG, F. (Eds.) *Proceedings of the BEAR 2006 Construction Sustainability and Innovation/CIB W89 International Conference on Building Education and Research,* Hong Kong.

AKINSOLA, A. O. (1997) *An intelligent model of variations' contingency on construction projects,* PhD. thesis, University of Wolverhampton, Wolverhampton.

ALKASS, S., MAZEROLLE, M. & HARRIS, F. (1998) Rigour in research and peer-review: a reply, *Construction Management & Economics,* **16** (2), 139.

ALLAIRE, Y. & FIRSIROTU, M. E. (1984) Theories of Organizational Culture, *Organization Studies,* **5** (3), 193-226.

ALVESSON, M. (2002) *Understanding organizational culture,* London; Thousand Oaks, California, SAGE.

AMARATUNGA, D. & BALDRY, D. (2002) Performance measurement in facilities management and its relationships with management theory and motivation, *Facilities,* **20** (10), 327-336.

AMERICAN HERITAGE DICTIONARY OF THE ENGLISH LANGUAGE (2000) Fourth Edition, Houghton Mifflin Company, http://dictionary.reference.com/search?q=culture [15/01/04].

ANDERSON, E. S. (2003) Understanding your project organization's character, *Project Management Journal,* **34** (4), 4.

ANKRAH, N. A. & LANGFORD D. A. (2005) Architects and Contractors: A comparative study of organizational cultures, *Construction Management and Economics*, **23** (6), 595-607**.**

ANKRAH, N. A. & PROVERBS, D. (2004) Treading the softer areas of construction management: A critical review of culture, IN KHOSROWSHAHI, F. (ed.), *Proceedings of the 20th Annual ARCOM Conference*, Edinburgh, **1**, 551-558.

ANKRAH, N. A. & PROVERBS, D. (2005) A framework for measuring construction project performance: overcoming key challenges of performance measurement, IN KHOSROWSHAHI, F. (Ed.) *Proceedings of the 21st Annual ARCOM Conference.* London, ARCOM.

ANKRAH, N. A., PROVERBS, D. & DEBRAH, Y. (2007b) Improving satisfaction with construction project outcomes: the role of culture, *Construction Management and Economics 25th Anniversary Conference.* Reading, UK, Construction Management and Economics.

ANKRAH, N. A., PROVERBS, D. & DEBRAH, Y. (2007d) Towards a model for diagnosing the culture of a construction project organisation, *International Journal of Construction Management, (Under review)*.

ANKRAH, N. A., PROVERBS, D., ANTWI, A. & DEBRAH, Y. (2005a) The influence of organisational culture on contractor performance, IN SULLIVAN, K. & KASHIWAGI, D. T. (Eds.) *Proceedings of the CIB W92/T23/W107 International Symposium on Procurement Systems: The Impact of Cultural Differences and Systems on Construction Performance*, Las Vegas, 2, 373-381.

ANKRAH, N. A., PROVERBS, D., ANTWI, A. & DEBRAH, Y. (2005b) Factors influencing organisational culture: A construction project perspective, IN EGBU, C. O. & TONG, M. K. L. (eds.), *Proceedings of the PRoBE 2005 Conference*, Glasgow.

ANKRAH, N. A., PROVERBS, D., ANTWI, A. & DEBRAH, Y. (2005c) Towards a new approach for measuring the organisational culture of construction project organisations: Overcoming the methodological challenges, IN EGBU, C. O. & TONG, M. K. L. (Eds.) *Proceedings of the PRoBE 2005 Conference.* Glasgow.

ANON (2005) Why the skills card scheme broke down, *Construction News,* (6943), 14.

ARDITI, D. & LEE, D. E. (2003) Assessing the corporate service quality performance of design-build contractors using quality function deployment, *Construction Management and Economics,* **21** (2), 175-185.

ARTAMA WIGUNA, I. P. & SCOTT, S. (2006) Relating risk to project performance in Indonesian building contracts, *Construction Management & Economics,* **24** (11), 1125.

ASHKANASY, N. M., BROADFOOT, L. E. & FALKUS, S. (2000) Questionnaire measures of organisational culture, IN ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F. (Eds.) *Handbook of organizational culture and climate.* California, Sage.

ASSAF, S. A., AL-HAMMAD, A. M. & UBAID, A. (1996) Factors effecting construction contractors' performance, *Building Research and Information,* **24** (3), 159-163.

ATKINSON, R. (1999) Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria, *International Journal of Project Management,* **17** (6), 337.

BABBIE, E. R. (1990) *Survey research methods,* Belmont, California, Wadsworth Pub. Co.

BACCARINI, D. (1996) The concept of project complexity – A review, *International Journal of Project Management*, **14** (4), 201.

BAGOZZI, R. P., YOUJAE, Y. & PHILLIPS, L. W. (1991) Assessing Construct Validity in Organizational Research, *Administrative Science Quarterly,* **36** (3), 421.

BAIDEN, B. K., PRICE, A. D. F. & DAINTY, A. R. J. (2006) The extent of team integration within construction projects, *International Journal of Project Management,* **24** (1), 13.

BAKER, K. A. (2002) *Organizational Culture,* http://www.sc.doe.gov/sc-5/benchmark/Ch%2011%20Organizational%20Culture%2006.08.02.pdf, [02/09/05].

BALDRY, D. (1996) Client benchmarking of contractor performance, IN LANGFORD, D. A. & RETIK, A. (Eds.) *Vol 2; Managing the construction project and managing risk*, London, 72-81.

BARTHORPE, S., DUNCAN, R. & MILLER, C. (2000) The pluralistic facets of culture and its impact on construction, *Property Management,* **18** (5), 335-351.

BASS, B. M. (1990) *Bass & Stogdill's Handbook of Leadership: Theory, research & management applications,* New York, Free Press.

BASSIONI, H. A., PRICE, A. D. & HASSAN, T. M. (2004) Performance Measurement in Construction, *Journal of Management in Engineering,* **20** (2), 42.

BATE, S. P. (1984) The impact of organizational culture on approaches to organizational problemsolving, *Organization Studies,* **5** (1), 43-66.

BBC (2002) *Wembley stadium chaos 'self-inflicted',* http://news.bbc.co.uk/1/hi/uk_politics/2119413.stm, [10/10/06].

BBC (2006) *Wembley Stadium faces more delays,* http://news.bbc.co.uk/1/hi/england/london/5139864.stm, [10/10/06].

BELASSI, W. & TUKEL, O. I. (1996) A new framework for determining critical success/failure factors in projects, *International Journal of Project Management,* **14** (3), 141-151.

BELOUT, A. (1998) Effects of human resource management on project effectiveness and success: Toward a new conceptual framework, *International Journal of Project Management,* **16** (1), 21-26.

BELOUT, A. & GAUVREAU, C. (2004) Factors influencing project success: the impact of human resource management, *International Journal of Project Management,* **22,** 1-11.

BLACK, C., AKINTOYE, A. & FITZGERALD, E. (2000) An analysis of success factors and benefits of partnering in construction, *International Journal of Project Management,* **18**, 423-434.

BODLEY, J. H. (1994) An Anthropological Perspective, *Cultural Anthropology: Tribes, States, and the Global System*.

BOOTH, J. (2005) Slow killer haunts industry, *Construction News,* (6943), 22-25.

BORMAN, W. C. (1978) Exploring upper limits of reliability and validity in performance ratings, *Joumal of Applied Psychology,* **63** 135-144.

BRESNEN, M., EDELMAN, L., NEWELL, S., SCARBROUGH, H. & SWAN, J. (2003) Social practices and the management of knowledge in project environments, *International Journal of Project Management,* **21** (3), 157.

BRINBERG, D. & MCGRATH, J. E. (1985) *Validity and the research process,* Beverly Hills; London, Sage.

BROWN, A. (1998) *Organisational culture,* Harlow, Pearson Education Limited.

BRYDE, D. J. & ROBINSON, L. (2005) Client versus contractor perspectives on project success criteria, *International Journal of Project Management,* **23** (8), 622.

BURNSIDE K & WESTCOTT (1999) AJ Market trends and developments in QS services, RICS COBRA Research Seminar

CAIN, C. T. (2004) *Performance measurement for construction profitability,* Victoria, Australia, Blackwell Pub.

CALIBRE (2000) *CALIBRE Project Management Service*, http://buildnet.csir.co.za/calibre & http://www.calibre2000.com/#, [28/04/05].

CCF/CBPP (1999) *Survey of construction clients' satisfaction: Headline results,* A joint Construction Clients' Forum, Construction Best Practice Programme and Carmague report.

CHAN, A. P. C., SCOTT, D. & CHAN, A. P. L. (2004) Factors Affecting the Success of a Construction Project, *Journal of Construction Engineering and Management,* **130** (1), 153-155.

CHAN, A. P. C., SCOTT, D. & LAM, E. W. M. (2002) Framework of Success Criteria for Design/Build Projects, *Journal of Management in Engineering,* **18** (3), 120.

CHAN, A. T. S. & CHAN, E. H. W. (2005) Impact of Perceived Leadership Styles on Work Outcomes: Case of Building Professionals, *Journal of Construction Engineering & Management,* **131** (4), 413.

CHAN, P., COOPER, R. & TZORTZOPOULOS, P. (2005) Organizational learning: conceptual challenges from a project perspective, *Construction Management & Economics,* **23** (7), 747.

CHERNS, A. B. & BRYANT, D. T. (1984) Studying the client's role in construction management, *Construction Management & Economics,* **2** (2), 177.

CHEUNG, S.-O., NG, T. S. T., WONG, S.-P. & SUEN, H. C. H. (2003) Behavioral aspects in construction partnering, *International Journal of Project Management,* **21** (5), 333.

CHING MING, T. & HARRIS, F. (1996) Model for assessing building contractors' project performance, *Engineering Construction and Architectural Management,* **3,** 187-204.

CHINYIO, E. A., OLOMOLAIYE, P. O., KOMETA, S. T. & HARRIS, F. C. (1998) A need based methodology for classifying construction clients and selecting contractors, *Construction Management and Economics,* **16**, 91-98.

CHRISTENSEN, E. W. & GORDON, G. G. (1999) An Exploration of Industry, Culture and Revenue Growth, *Organization Studies,* **Summer**, 1999.

CHUA, D. K. H., KOG, Y. C. & LOH, P. K. (1999) Critical Success Factors for Different Project Objectives, *Journal of construction engineering and management,* **125** (3), 142-150.

CIB (1999) *The improving performance of the UK construction industry,* A joint Construction Industry Board/Building Report, April, 1999.

CICMIL, S. & MARSHALL, D. (2005) Insights into collaboration at the project level: complexity, social interaction and procurement mechanisms, *Building Research & Information,* **33** (6), 523.

CIDB (2001) *QLASSIC: CIDB's Long-term initiative to measure construction quality,* http://www.cidb.gov.my/main.php?cid=742, [28/01/05].

CIIBM (2004) *Construction Industry Institute Benchmarking and Metrics,* http://cii-benchmarking.org/main_index.cfm, [28/04/05].

CITB (2002) *Equal opportunities: Stats & Facts,* http://www.citb.co.uk/equal_ops/, [04/03/05].

CLARK, P. & BARRICK, A. (2003) Holyrood: 300 design changes in July point to even more delays to come, *Building*.

COFFEY, M. W. (1996) The potential for employee involvement in construction, IN LANGFORD, D. & RETIK, A. (Eds.) *The organization and management of construction: Shaping theory and practice.* London, E & FN Spon.

COLUMBIA ENCYCLOPEDIA (2005) *The nature of culture*, http://www.encyclopedia.com/html/section/culture_TheNatureofCulture.asp, [02/09/05].

CONLEY, M. A. & GREGORY, R. A. (1999) Partnering on Small Construction Projects, *Journal of Construction Engineering and Management,* **125** (5), 320-324.

CONSTRUCTING EXCELLENCE (2004) *Culture and People,* www.constructingexcellence.org.uk, [30/11/06].

CONSTRUCTING EXCELLENCE (2006) *UK construction industry registers improved performance in 2006 Key Performance Indicators Survey,* http://www.constructingexcellence.org.uk/news/article.jsp?id=7846, [29/01/07].

COOK, E. L. & HANCHER, D. E. (1990) Partnering. Contracting for the future, *Journal of management in engineering,* **6** (4), 431-446.

COOKE, R. A. & SZUMAL, J. L. (2000) Using the Organizational Culture Inventory to understand the operating cultures of organisations, IN ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F. (Eds.) *Handbook of organizational culture and climate.* California, Sage.

COOPER, A. (1998) Business Process Reengineering and organisational culture, *Unpublished thesis*, www.managingchange.com/bpr/bprcult/3culture.htm, [02/09/05].

COOPER, M. D. & PHILLIPS, R. A. (1995) Killing two birds with one stone: achieving quality via total safety management, **16** (8), p3(7).

COOPER, M. D. (2000) Towards a model of safety culture, *Safety Science*, **36**, 111-136

COSTA, D. B. & FORMOSO, C. T. (2004) Evaluating performance measurement systems for construction companies, *IN*: AOUAD, G., AMARATUNGA, D., KAGIOGLOU, M., RUDDOCK, L. & SEXTON, M. (Eds.), *The International Salford Centre for Research and Innovation (SCRI) Research Symposium*.

COSTANTINO, N., PIETROFORTE, R. & HAMILL, P. (2001) Subcontracting in commercial and residential construction: an empirical investigation, *Construction Management & Economics,* **19** (4), 439.

CREATIVE RESEARCH SYSTEMS (2003) *The survey system,* http://www.surveysystem.com/sscalc.htm, [14/07/05].

CRESWELL, J. W. (2003) *Research design: qualitative, quantitative, and mixed method approaches,* Thousand Oaks, Calif., Sage Publications.

CRISP Culture and People Task Group (2002) Culture and people in construction – a research strategy, *CRISP Report*, UK.

CROWLEY, L. & KARIM, A. (1995) Conceptual model of partnering, *Journal of management in engineering,* **11** (5), 33-39.

CZAJA, R. & BLAIR, J. (1996) *Designing surveys: a guide to decisions and procedures,* Thousand Oaks, California; London, Pine Forge Press.

DAINTY, A. R. J., BAGILHOLE, B. M. & NEALE, R. H. (2002) Coping with construction culture: A longitudinal case study of a woman's experiences of working on a British construction site IN: FELLOWS, R. & SEYMOUR, D. E., *Perspectives on culture in construction,* CIB Report, Vol. **275**, 221-237.

DAINTY, A., BAGILHOLE, B. & GREEN, S. (Eds.) (2007) *People and Culture in Construction: A Reader*, Routledge.

DAINTY, A., CHENG, M.-I. & MOORE, D. (2003) Redefining performance measures for construction project managers: an empirical evaluation, *Construction Management & Economics,* **21** (2), 209-218.

DAINTY, A. R. J., CHENG, M.-I. & MOORE, D. R. (2004) A competency-based performance model for construction project managers, *Construction Management and Economics,* **22** (8), 877-886.

DAINTY, A., CHENG, M.-I. & MOORE, D. (2005) A comparison of the behavioral competencies of client-focused and production-focused project managers in the construction sector, *Project Management Journal,* **36** (2), 39.

DEAL, T. E. & KENNEDY, A. A. (1982) *Corporate cultures: the rites and rituals of corporate life,* Reading, Mass., Addison-Wesley Pub. Co.

DELOBBE, N., HACCOUN, R. R. & VANDENBERGHE, C. (2002) Measuring Core Dimensions of Organizational Culture: A Review of Research and Development of a New Instrument, *Unpublished manuscript.* Universite catholique de Louvain, Belgium, www.iag.ucl.ac.be/recherche/Papers/wp53.pdf, [16/05/05].

DENISON, D. R. & MISHRA, A. K. (1995) Toward a theory of organizational effectiveness, *Organization Science,* **6** (2), 204-223.

DETR (2000) *Building a better quality of life: A strategy for more sustainable construction*, http://www.dti.gov.uk/construction/sustain/bql/pdf/sus_cons.pdf, [13/06/05].

DICKSON, M. W., ADITYA, R. N. & CHHOKAR, J. S. (2000) Definition and interpretation in cross-cultural organizational culture research: Some pointers from the GLOBE research program, IN ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F. (Eds.) *Handbook of organizational culture and climate*, California, Sage.

DOZZI, P., HARTMAN, F., TIDSBURY, N. & ASHRAFI, R. (1996) More-Stable Owner-Contractor Relationships, *Journal of Construction Engineering and Management,* **122**, (1), 30-35.

DREXLER, J. A. & LARSON, E. W. (2000) Partnering: Why project owner-contractor relationships change, *Journal of construction engineering and management,* **126** (4), 293-297.

DTI (2004) *Key Performance Indicators,* http://www.dti.gov.uk/construction/kpi/, [11/08/04].

DTI (2005) *Construction Statistics Annuals 2005,* Department of Trade and Industry (HMSO), London.

DTI (2006) *Construction Statistics - Output and Employment Quarter 1 2006,* Department of Trade and Industry [http://www.dti.gov.uk/sectors/construction/ConstructionStatistics/OutputandEmployment/quarter106/page29702.html], [15/06/06].

DUNCAN, R., NEALE, R. & BAGILHOLE, B. (2002) Equality of opportunity, family friendliness and UK construction industry culture, IN FELLOWS, R. & SEYMOUR, D. E. (Eds.) *Perspectives on culture in construction,* CIB Report, **275**.

EATON CONSULTING GROUP INC. (2002) *Rebuilding the Motorway in Croatia: Bechtel/ENKA Project*, Available at: http://www.eatonconsultinggroup.com/highlights.html [20/04/04]

EGAN, J. (1998) *Rethinking construction,* Construction Task Force, London, HMSO.

EGAN, J. (2002) *Accelerating change,* Strategic Forum for Construction, London.

ELDRIDGE, J. E. T. & CROMBIE, A. D. (1975) *A sociology of organisations*, International Publications Service, New York.

EREZ, M. & GATI, E. (2004) A dynamic, multi-level model of culture: From the micro level of the individual to the macro level of a global culture, *Applied psychology: An international review,* **53** (4), 583-598.

FELLOWS, R. & LIU, A. (1997) *Research methods for construction*, Blackwell Science, Oxford; Malden, MA, USA.

FELLOWS, R. & LIU, A. (2002) Impact of behavioural compatibility on project procurement, IN FELLOWS, R. F. & SEYMOUR, D. E. (Eds.) *Perspectives on culture in construction,* CIB report, **275**.

FELLOWS, R. & SEYMOUR, D. E. (Eds.) (2002) *Perspectives on culture in construction*, CIB Report.

FELLOWS, R., LANGFORD, D., NEWCOMBE, R. & URRY, S. (2002) *Construction management in practice,* Oxford, Blackwell Science.

FENN, P. (1997) Rigour in research and peer review, *Construction Management & Economics,* **15** (4), 383.

FENN, P., LOWE, D. & SPECK, C. (1997) Conflict and dispute in construction, *Construction Management and Economics,* **15,** 513-518.

FIELD, A. P. (2000) *Discovering statistics using SPSS for Windows: advanced techniques for the beginner,* London; Thousand Oaks, Sage Publications.

FORD, D. N. (2002) Achieving Multiple Project Objectives through Contingency management, *Journal of Construction Engineering & Management,* **128** (1), 30.

FORTUNE, J. & WHITE, D. (2006) Framing of project critical success factors by a systems model, *International Journal of Project Management,* **24** (1), 53.

GARSON, D. (2007a) *Cluster Analysis,* http://www2.chass.ncsu.edu/garson/PA765/cluster.htm, [01/01/07].

GARSON, D. (2007b) *Validity,* http://www2.chass.ncsu.edu/garson/PA765/cluster.htm, [20/03/07].

GARSON, D. G. (2006a) *Reliability analysis: Key concepts and terms*, http://www2.chass.ncsu.edu/garson/pa765/reliab.htm [08/08/06]

GARSON, D. G. (2006b) *Scales and standard measures: Key concepts and terms*, http://www2.chass.ncsu.edu/garson/pa765/standard.htm [08/08/06]

GEERTZ, C. (2001) The interpretation of cultures: selected essays, New York, N.Y., BasicBooks.

GESTELAND, R. R. (1999) *Cross-cultural business behavior: marketing, negotiating, and managing across cultures,* 2nd edition, Copenhagen Business School Press, Copenhagen.

GIDADO, K. I. (1996) Project complexity: The focal point of construction production planning, *Construction Management & Economics,* **14** (3), 213.

GLOBERSON, S. & ZWIKAEL, O. (2002) The Impact of the Project Manager on Project Management Planning Processes, *Project Management Journal,* **33** (3), 58-64.

GODFREY, P. S. (1996) Control of Risk – A Guide to the Systematic Management of Risk from Construction, *CIRIA Special Publication,* London, CIRIA, **125**.

GONZALEZ-DIAZ, M., ARRUNADA, B. & FERNANDEZ, A. (2000) Causes of subcontracting: evidence from panel data on construction firms, *Journal of Economic Behavior & Organization,* **42** (2), 167.

GOOD, P. I. & HARDIN, J. W. (2003) *Common errors in statistics (and how to avoid them),* Hoboken, NJ, Wiley-Interscience.

GOODENOUGH, W. H. (2003) In pursuit of culture, *Annual Review of Anthropology,* **32**, 1-12.

GRAVES, D. (1986) *Corporate culture – diagnosis and change: auditing and changing the culture of organizations,* St. Martin's Press, New York.

GREENWOOD, D. (2001) Subcontract procurement: are relationships changing? *Construction Management & Economics,* **19** (1), 5.

GRIFFITH, A. (2000) Integrated management systems: a single management system solution for project control? *Engineering Construction & Architectural Management,* **7** (3), 232.

GRIFFITH, A. F., GIBSON, G. E., HAMILTON, M. R., TORTORA, A. L. & WILSON, C. T. (1999) Project success index for capital facility construction projects, *Journal of performance of constructed facilities,* **13** (1), 39-45.

GUEST, D. E., MICHIE, J., CONWAY, N. & SHEEHAN, M. (2003) Human resource management and corporate performance in the UK, *British Journal of Industrial Relations,* **41** (2), 291-314.

HAGBERG, R. & HEIFETZ, J. (2000) *Corporate Culture/Organizational Culture: Understanding and Assessment - Telling the CEO his/her baby is ugly*, http://www.hcgnet.com/html/articles/understanding-Culture.html [2/7/03]

HAIR, J. F., ANDERSON, R. E., TATHAM, R. L. & BLACK, W. C. (1998) *Multivariate data analysis,* Upper Saddle River, N.J., Prentice Hall.

HALE, A. R. (2000) Culture’s confusions, *Safety science*, **34**, 1-14.

HALL, E. T. & HALL, M. R. (1990) *Understanding cultural differences*, Intercultural Press, Yarmouth, Me.

HALL, J. R. & NEITZ, M. J. (1993) *Culture: sociological perspectives,* Englewood Cliffs, N.J., Prentice Hall.

HALL, M. A. (1999) *International construction management: the cultural dimension,* PhD. Thesis, Liverpool John Moores University, Liverpool.

HAMMOND, F. N. (2006) The economic impacts of Sub-Saharan Africa urban real estate policies, *PhD thesis*, School of Engineering and the Built Environment, University of Wolverhampton, Wolverhampton.

HAMMOND, P. B. (1978) *An introduction to cultural and social anthropology,* New York, Macmillan Publishing Co.

HAMPDEN-TURNER, C. (1994) *Corporate culture*, Piatkus.

HANDLEY, P. (1997) *BOT Privatisation in Asia: Distorted goals and processes,* http://wwwarc.murdoch.edu.au/wp/wp82.rtf, [23/03/04].

HANDY, C. B. (1993) *Understanding organizations*, Oxford University Press, New York.

HANDY, C. B. (1995) *Gods of management: the changing work of organizations*, Oxford University Press, New York.

HANNA, A. S., CAMLIC, R., PETERSON, P. A. & NORDHEIM, E. V. (2002) Quantitative Definition of Projects Impacted by Change Orders, *Journal of Construction Engineering & Management,* **128** (1), 57.

HARI, S., EGBU, C. & KUMAR, B. (2005) A knowledge capture awareness tool: An empirical study on small and medium enterprises in the construction industry, *Engineering, Construction and Architectural Management,* **12** (6), 533-567.

HARRIS, F. & MCCAFFER, R. (2001) *Modern construction management,* Oxford, UK; Malden, MA, Blackwell Science.

HARTMANN, A. (2006) The context of innovation management in construction firms, *Construction Management & Economics,* **24** (6), 567.

HARVEY, R. C. & ASHWORTH, A. (1997) *The Construction Industry of Great Britain,* Oxford, Laxton's.

HATCH, M. J. (1993) The dynamics of organizational culture, *Academy of Management Review,* **18** (4), 657-693.

HATUSH, Z. & SKITMORE, M. (1997a) Criteria for contractor selection, *Construction Management and Economics,* **15**, 19-38.

HATUSH, Z. & SKITMORE, M. (1997b) Evaluating contractor pre-qualification data: selection criteria and project success factors, *Construction Management and Economics,* **15,** 129-147.

HOBDAY, M. (2000) The project-based organisation: an ideal form for managing complex products and systems? *Research policy,* **29,** 871-893.

HOFSTEDE, G. (1984) *Culture's consequences: international differences in work-related values,* Abridged ed, Sage, London; Beverly Hills.

HOFSTEDE, G. (2001) *Culture's consequences: comparing values, behaviors, institutions, and organizations across nations,* London; Thousand Oaks, California, Sage Publications.

HOFSTEDE, G. H. (1997) *Cultures and organizations: software of the mind,* [Rev., McGraw-Hill, New York.

HOFSTEDE, G. & FINK, G. (2007) Culture: organisations, personalities and nations, *European Journal of International Management,* **1** (1/2), 14-22.

HOFSTEDE, G., BOND, M. H. & LUK, C. L. (1993) Individual Perceptions of Organizational Cultures: A Methodological Treatise on Levels of Analysis, *Organization Studies,* **14** (4), 483.

HOFSTEDE, G., NEUIJEN, B., OHAYV, D. D. & SANDERS, G. (1990) Measuring organizational cultures: A qualitative and quantitative study across twenty cases, *Administrative Science Quarterly,* **35** (2), 286-316.

HOLT, G. D., OLOMOLAIYE, P. O. & HARRIS, F. C. (1994) Evaluating prequalification criteria in contractor selection, *Building and Environment,* **29,** 437.

HSE (2006) *Construction,* Health & Safety Executive, http://www.hse-databases.co.uk/construction/index.htm, [19/06/06].

HSIEH, T.-Y. (1998) Impact of subcontracting on site productivity: Lessons learned in Taiwan, *Journal of Construction Engineering & Management,* **124** (2), 91-100.

IBERT, O. (2004) Projects and firms as discordant complements: organisational learning in the Munich software ecology, *Research policy,* **33** (10), 1529-1546.

INFOPLEASE (2005) *Theories of culture,* The Columbia Electronic Encyclopedia, http://www.infoplease.com/ce6/society/A0857661.html, [10/10/05].

IVE, G., GRUNEBERG, S., MEIKLE, J. & CROSTHWAITE, D. (2004) Measuring the competitiveness of the UK construction industry, DTI.

KADEFORS, A. (2004) Trust in project relationships - inside the black box, *International journal of project management,* **22,** 175-182.

KAMING, P. F., OLOMOLAIYE, P. O., HOLT, G. D. & HARRIS, F. C. (1997) Factors influencing construction time and cost overruns on high-rise projects in Indonesia, *Construction Management and Economics,* **15** (1), 83-94.

KAPLAN, R. S. & NORTON, D. P. (1992) The balanced scorecard - measures that drive performance, *Havard Business Review,* **70,** 71-79.

KAPLAN, R. S. & NORTON, D. P. (1996) *The balanced scorecard; Translating strategy into action,* Havard Business School Press, Boston, MA.

KASHIWAGI, D. & BYFIELD, R. E. (2002) Selecting the best contractor to get performance: On time, on budget, meeting quality expectations, *Journal of Facilities Management,* **1** (2), 103-116.

KASHIWAGI, D., SAVICKY, J. & SULLIVAN, K. (2006) Is performance-based procurement a solution to construction performance? *Keynote address, International Conference in the Built Environment in the 21st Century (ICiBE2006).* Kuala Lumpur, Malaysia.

KEESING, R. M. (1974) Theories of culture, *Annual Review of Anthropology*.

KERLINGER, F. N. & LEE, H. B. (2000) *Foundations of behavioral research,* Fort Worth; London, Harcourt College Publishers.

KERNON, S. (2005) Cancer is 'epidemic', *Construction News,* (6945), 4.

KING, N. (1994) The Qualitative Research Inteview, IN CASSELL, C. & SYMON, G. (Eds.) *Qualitative methods in organizational research: a practical guide*, London; Thousand Oaks, Calif., Sage Publications.

KINNEAR, P. R. & GRAY, C. D. (2004) *SPSS 12 made simple,* Hove, East Sussex; New York, Psychology Press.

KOG, Y. C., CHUA, D. K. H., LOH, P. K. & JASELSKIS, E. J. (1999) Key determinants for construction schedule performance, *International Journal of Project Management,* **17** (6), 351.

KOMPASS (2006) *Kompass: the authority on British industry. [Vol.1]. Products and services*, East Grinstead: Reed Information Services.

KOTTER, J. P. & HESKETT, J. L. (1992) *Corporate culture and performance,* New York, Toronto, Free Press; Maxwell Macmillan Canada; Maxwell Macmillan International.

KULULANGA, G. K., EDUM-FOTWE, F. T. & MCCAFFER, R. (2001) Measuring construction contractors' organizational learning, *Building Research & Information,* **29** (1), 21.

KUMARASWAMY, M. M., CHAN, D. W. M., DISSANAYAKA, S. M. & YOGESWARAN, K. (1997) Mapping Methodologies and Mixing Methods in Construction Management Research, *Proceedings of the 13th Annual ARCOM Conference,* Cambridge, UK, ARCOM, 471-480.

KUMARASWAMY, M., ROWLINSON, S., RAHMAN, M. & PHUA, F. (2002) Strategies for triggering the required 'cultural revolution' in the construction industry, IN: FELLOWS, R. F. & SEYMOUR, D. E. (Eds.) *Perspectives on culture in construction*, CIB Report, Vol. **275**.

KWAKYE, A. A. (1994) *Understanding tendering and estimating,* Aldershot, Hampshire, England; Brookfield, Vt., USA, Gower Pub.

LATHAM, M. (1994) *Constructing the team, Final report of the government/industry review of procurement and contractual arrangements in the United Kingdom construction industry*, London, HMSO, Department of Environment.

LARSON, E. (1997) Partnering on construction projects: A study of the relationship between partnering activities and project success, *IEEE Transactions on Engineering Management,* **44,** 188-195.

LEUNG, M.-Y., LIU, A. M. M. & NG, S. T. (2005) Is there a relationship between construction conflicts and participants' satisfaction? *Engineering, Construction and Architectural Management,* **12** (2), 149-167.

LEUNG, M.-Y., NG, S. T. & CHEUNG, S.-O. (2004) Measuring construction project participant satisfaction, *Construction Management & Economics*, **22** (3), 319.

LIM, C. S. & MOHAMED, M. Z. (1999) Criteria of project success: an exploratory re-examination, *International Journal of Project Management,* **17** (4), 243-248.

LINGARD, H. & ROWLINSON, S. (2006) Letter to the Editor, *Construction Management & Economics,* **24** (11), 1107-1109.

LITTLEFIELD, D. (1998) Hard hats, soft skills, *People Management,* **4** (24), 34.

LIU A. M. (2002) Keys to harmony and harmonic keys, *In*: Fellows, R. and Seymour, D. E. (Eds.) *Perspectives on culture in construction*, CIB Report, **275**.

LIU, A. M. M. (1999) Culture in the Hong Kong real-estate profession: a trait approach, *Habitat International,* **23** (3), 413-425.

LIU, A. M. M. & WALKER, A. (1998) Evaluation of project outcomes, *Construction Management & Economics,* **16** (2), 209.

LIU, A., FELLOWS, R. & FANG, Z. (2003) The power paradigm of project leadership, *Construction Management and Economics,* **21** (8), 819-829.

LIU, A. M. M., ZHANG, S. & LEUNG, M. (2006) A framework for assessing organisational culture of Chinese construction enterprises, *Engineering Construction & Architectural Management,* **13** (4), 327-342.

LOOSEMORE, M. (1998) The three ironies of crisis management in construction projects, *International Journal of Project Management,* **16** (3), 139.

LOOSEMORE, M. (2002) Prejudice and racism in the construction industry, IN FELLOWS, R. & SEYMOUR, D. E. (Eds.) *Perspectives on culture in construction.* CIB Report, **275**.

LOPRESTI, F. (1998) *New SPSS Missing Values Analysis Option,* http://www.nyu.edu/its/pubs/connect/archives/98fall/loprestimissing.html, [14/11/06].

LORENZ, K. & MAROSSZEKY, M. (2004) Intercultural management for international construction projects - A comparison of Austria and Germany with Australia, IN: KHOSROWSHAHI, F. (Ed.) *Proceedings of the 20th Annual ARCOM Conference*, Edinburgh, Vol. **1**, 427-436.

LOVE, P. E. D., EDWARDS, D. J. & SOHAL, A. (2004) Total quality management in Australian contracting organisations: pre-conditions for successful implementation, *Engineering Construction & Architectural Management,* **11** (3), 189.

LOVE, P. E. D. & HENG, L. (2000) Quantifying the causes and costs of rework in construction, *Construction Management & Economics,* **18** (4), 479.

LOW, S. P. & SHI, Y. (2001) Cultural influences on organizational processes in international projects: two case studies, *Work Study,* **50** (7), 276-285.

MAISEL, R. & PERSELL, C. H. (1996) *How sampling works,* Thousand Oaks, California, Pine Forge Press.

MAJID, M. Z. A. & MCCAFFER, R. (1998) Factors of Non-Excusable Delays That Influence Contractors' Performance, *Journal of Management in Engineering,* **14** (3), 42-49.

MALONEY, W. F. & FEDERLE, M. O. (1990) *Organizational culture in engineering and construction organizations,* University of Michigan, Ann Arbor.

MALONEY, W. F. (2002) Construction product or service and customer satisfaction, *Journal of Construction Engineering and Management,* **128** (6), 522-529.

MALONEY, W. F. (2003) Labor-Management Cooperation and Customer Satisfaction, *Journal of Construction Engineering & Management,* **129** (2), 165.

MARTIN, J. (1992) *Cultures in organizations: three perspectives*, Oxford University Press, New York.

MASAOKA, Y. (2003) *Key elements of private infrastructure financing in the Asia-Pacific region*, Nagasaki University, http://www.econ.nagasaki-u.ac.jp/info/ra/dp_arc/02_03/dp_0203.pdf [15/03/04].

MBUGUA, L. M. (2000) A methodology for evaluating the business performance of UK construction companies, *Unpublished PhD thesis*, School of Engineering and the Built Environment, University of Wolverhampton, Wolverhampton.

MCCOMB, S. A., GREEN, S. G. & COMPTON, W. D. (1999) Project Goals, Team Performance, and Shared Understanding, *Engineering Management Journal,* **11** (3), 7pp.

MCFILLEN, J. M. & MALONEY, W. F. (1988) New answers and new questions in construction worker motivation, *Construction Management & Economics,* **6** (1), 35.

MCNAMARA, C. (1999) *Organisational culture,* http://www.mapnp.org/library/org_thry/culture/culture.htm, [27/02/04].

MEUDELL, K. & GADD, K. (1994) Culture and climate in short life organizations: sunny spells or thunderstorms, *International Journal of Contemporary Hospitality Management,* **6**, (5), 27-32.

MICHELA, J. L. & BURKE, W. W. (2000) Organizational culture and climate in transformations for quality and innovation, IN ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F. (Eds.) *Handbook of organizational culture and climate*, California, Sage.

MIRAGLIA, E., LAW, R. & COLLINS, P. (1999) *What Is Culture?*, [15/01/04].

MOSELHI, O., ASSEM, I. & EL-RAYES, K. (2005) Change Orders Impact on Labor Productivity, *Journal of Construction Engineering & Management,* **131** (3), 354.

MULLINS, L. J. (1993) *Management and Organisational Behaviour,* Pitman Publishing, London.

MULLINS, L. J. (2005) *Management and organisational behaviour,* Harlow, England; New York, Prentice Hall/Financial Times.

MUNN, P. & DREVER, E. (1990) *Using questionnaires in small-scale research: A teachers' guide*, SCRE, Edinburgh.

NAOUM, S. (2003) An overview into the concept of partnering, *International journal of project management,* **21** (1), 71-76.

NEUIJEN, B. (2002) National and organisational cultures: Implicit images, *CIB Report,* **275**.

NEWCOMBE, R. (2003) From client to project stakeholders: a stakeholder mapping approach, *Construction Management and Economics,* **21** 841-848.

NG, S. T. & SKITMORE, R. M. (1999) Client and consultant perspectives of prequalification criteria, *Building and Environment,* **34,** 607-622.

NGOWI, A. B. (2000) Impact of culture on the application of TQM in the construction industry in Botswana, *International Journal of Quality & Reliability Management,* **17**, 442-452(11).

NICOLINI, D. (2002) In search of 'project chemistry', *Construction Management & Economics,* **20** (2), 167.

OFORI, G. (2000) Challenges of construction industries in developing countries: Lessons from various countries, *2nd International Conference on Construction in Developing Countries: Challenges facing the construction industry in developing countries.* Gabarone, Botswana, http://buildnet.csir.co.za/cdcproc/2nd_proceedings.html.

OGBONNA, E. & HARRIS, L. C. (2000) Leadership style, organizational culture and performance: empirical evidence from UK companies, *International Journal of Human Resource Management,* **11** (4), 766-788.

OGBONNA, E. & HARRIS, L. C. (2002) Organizational Culture: A Ten Year, Two-Phase Study of Change in the UK Food Retailing Sector, *Journal of Management Studies,* **39,** 673-706.

OGC (2007) *Effective Partnering: An overview for customers and providers,* http://www.ogc.gov.uk/delivery_lifecycle_effective_partnering_an_overview_for_customers_and_providers.asp, [16/02/07].

OLIVER, R. L. (1997) *Satisfaction: a behavioral perspective on the consumer*, McGraw Hill, New York.

OLOMOLAIYE, P. O., JAYAWARDANE, A. K. W. & HARRIS, F. (1998) *Construction productivity management,* Longman, Essex, England.

OMOREGIE, A. (2006) Blueprints for infrastructure and service delivery in SubSaharan Africa, *PhD thesis*, The Leicester School of Architecture, De Montfort University, Leicester.

ONS (2002) *UK Standard Industrial Classification of Economic Activities 2003,* Office for National Statistics, HMSO, London.

ONS (2006) *GDP: Measuring the UK's economic activity,* http://www.statistics.gov.uk/cci/nugget.asp?id=56, [24/12/06].

OSBORNE, J. W. & COSTELLO, A. B. (2004) Sample size and subject to item ratio in principal components analysis, *Practical Assessment, Research & Evaluation,* **9** (11).

OUCHI, W. G. (1981) *Theory Z: how American business can meet the Japanese challenge,* Reading, Mass., Addison-Wesley.

PACKHAM, G., THOMAS, B. & MILLER, C. (2003) Partnering in the house building sector: A subcontractor's view, *International journal of project management*, 21 (5), 327-332.

PAJARES, F. (2002) *Overview of social cognitive theory and of self-efficacy,* http://www.emory.edu/EDUCATION/mfp/eff.html, [01/07/05].

PANT, D. P., ALLINSON, C. W. & HAYES, J. (1996) Transferring the western model of project organisation to a bureaucratic culture: The case of Nepal, *International journal of project management,* **14** (1), 53-57.

PAYNE, M. (1996) *A dictionary of cultural and critical theory,* Oxford, OX, UK; Cambridge, Mass., USA, Blackwell Reference.

PAYNE, R. L. (2000) Climate and culture: How close can they get? IN: ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F (Eds.) *Handbook of organizational culture*, Sage Publications.

PEARCE, D. (2003) The social and economic value of construction: The construction industry's contribution to sustainable development, London, nCRISP.

PETERS, T. J. & WATERMAN, R. H. (1982) *In search of excellence: lessons from America's best-run companies,* New York, Harper & Row.

PHUA, F. T. T. & ROWLINSON, S. (2003) Cultural differences as an explanatory variable for adversarial attitudes in the construction industry: the case of Hong Kong, *Construction Management and Economics,* **21,** 777-785.

PHUA, F. T. T. & ROWLINSON, S. (2004) Operationalising culture in construction management research: a social identity perspective in the Hong Kong context, *Construction Management and Economics,* **22,** 913-925.

PICARD, R. R. & BERK, K. N. (1990) Data Splitting. *American Statistician,* **44** (2), 140-147.

PRIOR, G. (2005) Unions aim high for Blue Book pay review, *Construction News,* (6945), 5.

PRIOR, G. (2006) Building bosses at breaking point, *Construction News,* (6965), 6.

PROVERBS, D. (1998) A best practice model for high-rise in situ concrete construction based on French, German and UK contractor performance measures, *PhD thesis*, School of Engineering and the Built Environment, University of Wolverhampton, Wolverhampton.

PROVERBS, D. G. & FANIRAN, O. O. (2001) International construction performance comparisons: a study of `European' and Australian contractors, *Engineering Construction and Architectural Management,* **8** (4), 284-291.

PROVERBS, D. G., HOLT, G. D. & OLOMOLAIYE, P. O. (1997) Factors influencing the choice of concrete supply methods, *Building Research & Information,* **25** (3), 176.

PROVERBS, D. G., HOLT, G. D. & OLOMOLAIYE, P. O. (1999) Productivity rates and construction methods for high rise concrete construction: a comparative evaluation of UK, German and French contractors, *Construction Management and Economics,* **17** (1), 45-52.

QUINN, R. E. (1988) Beyond rational management: mastering the paradoxes and competing demands of high performance, Jossey-Bass, San Francisco.

RAFTERY, J., MCGEORGE, D. & WALTERS, M. (1997) Breaking up methodological monopolies: a multi-paradigm approach to construction management research, *Construction Management & Economics,* **15** (3), 291.

RAMEEZDEEN, R. & GUNARATHNA, N. (2003) Organizational culture in construction: an employee perspective, *The Australian Journal of Construction Economics and Building,* **3**, (1).

REASON, P. & ROWAN, J. (1981) Issues of validity in new paradigm research, IN REASON, P. & ROWAN, J. (Eds.) *Human inquiry: a sourcebook of new paradigm research.* Chichester, Wiley.

REISNER, A. (2005) A wealth of contenders worthy of the top prize, *Construction News,* (6945), 22-25.

RICS (2006) Contracts in use: A survey of building contracts in use during 2004, London, The Royal Institution of Chartered Surveyors.

RILEY, M. J. & CLARE-BROWN, D. (2001) Comparison of cultures in construction and manufacturing industries, *Journal of Management in Engineering,* **17**, (3), 149-158.

RIMMER, M. (2006) Bias is shameful waste, *Construction News,* (6965), 14.

RITTER, M. (2003) The use of balanced scorecards in the strategic management of corporate communication, *Corporate communications: An international journal,* **8** (1), 44-59.

ROBBINS, S. P. (1998) *Organizational behavior: concepts, controversies, applications,* Upper Saddle River, N.J., Prentice Hall.

ROBERTS, K. H. & BOYACIGILLER, N. A. (1993) Cross-National Organizational Research: The Grasp of the Blind Men, *De Gruyter Studies in Organization***,** 51.

ROOKE, J. (2001) Developing a culture of quality in the British construction industry: a report on research in progress, *In* Tijhuis, W. (Ed.) *Culture in construction - Part of the deal? CIB Proceedings*, University of Twente, The Netherlands, 255.

ROOKE, J. & SEYMOUR, D. (2002) Ethnography in the construction industry: Competing bodies of knowledge in civil engineering, *CIB Report,* **275**

ROOKE, J., SEYMOUR, D. & CROOK, D. (1997) Preserving methodological consistency: a reply to Raftery, McGeorge and Walters, *Construction Management & Economics,* **15** (5), 491.

ROOKE, J., SEYMOUR, D. & FELLOWS, R. (2004) Planning for claims: an ethnography of industry culture, *Construction Management and Economics,* **22**, 655-662.

ROOT, D. (2002) Validating occupational imagery in construction; Applying Hofstede's VSM to occupations and roles in the UK construction industry, IN: FELLOWS, R. F. & SEYMOUR, D. E. (Eds.) *Perspectives on culture in construction*, *CIB Report*, **275**, 151-171.

ROSENTHAL, R. & ROSNOW, R. L. (1991) *Essentials of behavioral research: methods and data analysis,* New York; London, McGraw-Hill.

ROWLINSON, S. & CHEUNG, F. Y. K. (2004) A review of the concepts and definitions of the various forms of relational contracting, *International Symposium of the CIB W92 on Procurement Systems "Project Procurement for Infrastructure Construction"*, 7 – 10 January, 2004, Chennai, India.

RUNESON, G. R. & LOOSEMORE, M. (1999) Gate-keepers or judges: peer reviews in construction management, *Construction Management & Economics,* **17** (4), 529.

RUSSELL, J. S., JASELSKIS, E. J. & LAWRENCE, S. P. (1997) Continuous Assessment of Project Performance, *Journal of Construction Engineering and Management,* **123,** 64-71.

SAWACHA, E., NAOUM, S. & FONG, D. (1999) Factors affecting safety performance on construction sites, *International Journal of Project Management,* **17** (5), 309.

SAXE, J. G. (1963) "*The Blind Men and the Elephant; John Godfrey Saxe's version of the famous Indian legend.*" http://www.noogenesis.com/pineapple/blind_men_elephant.html, [19/02/04].

SCHEIN, E. (1985) *Organizatonal Culture and leadership,* San Francisco, Washington, London, Jossey-Bass Publishers.

SCHEIN, E. (2000) Sense and nonsense about culture and climate IN: ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F. (Eds.), *Handbook of organizational culture and climate*, Sage, California.

SCHNEIDER, B. (2000) The psychological life of organizations IN: ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F. (Eds.), *Handbook of organizational culture and climate*, Sage, California.

SEELEY I. H. (1997) *Quantity Surveying Practice*, Second Edition, London, Macmillan.

SERPELL, A. F. & RODRIGUEZ, D. (2002) Studying construction organisational culture: Preliminary findings, IN: FELLOWS, R. F. & SEYMOUR, D. E. (Eds.) *Perspectives on culture in construction*, CIB Report, **275**, 76-91.

SEYMOUR, D. & ROOKE, J. (1995) The culture of the industry and the culture of research, *Construction Management & Economics,* **13** (6), 511.

SHAMMAS-TOMA, M., SEYMOUR, D. & CLARK, L. (1998) Obstacles to implementing total quality management in the UK construction industry, *Construction Management & Economics,* **16** (2), 177.

SILVERMAN, D. (1993) *Interpreting qualitative data: methods for analysing talk, text and interaction,* London, Sage.

SIMON (1944) The placing and management of building contracts: report of the central council for works and building, London, HMSO.

SKITMORE, R. M., TONE, K. & TRAN, D. (2004) The impact of culture on project communications: Two case studies from S.E. Asia, IN OGUNLANA (Ed.) *Proceedings of the International Symposium on Globalisation and Construction, 17-19 November.* Bangkok, Thailand.

SMIRCICH, L. (1983) Concepts of culture and organisational analysis, *Administrative Science Quarterly,* **28,** 339-358.

SMITH, C. (2000) Organizational culture in practice, *Human Resource Development International,* **3** (2), 153-158.

SMITH, L. F. (2001) Development of a multidimensional labour satisfaction questionnaire: dimensions, validity and internal reliability, Quality in Health Care, **10** (1), 17-22.

SMITH, M. E. (2003) Changing an organization's culture: correlates of success and failure, *Leadership & Organization Development Journal,* **24**, 249-261.

SMITHERS, G. L. & WALKER, D. H. T. (2000) The effect of the workplace on motivation and demotivation of construction professionals, *Construction Management & Economics,* **18** (7), 833.

SNEE, R. D. (1977) Validation of regression models: Methods and examples, *Technometrics,* **19** (4), 415-428.

SOETANTO, R. (2002) *Modelling satisfaction for main participants of the construction project coalition: a study of mutual performance assessment,* Ph.D. thesis, University of Wolverhampton, Wolverhampton.

SOETANTO, R., PROVERBS, D. & COOPER, P. (1999) A conceptual model of performance and satisfaction for main participants of construction project coalitions, *Proceedings of ARCOM 15th Annual Conference.* John Moores University, Liverpool, ARCOM.

SOETANTO, R., PROVERBS, D. G. & COOPER, P. (2002) A tool for Assessing Contractor Performance, *Journal of Construction Procurement,* **8** (1), 48-63.

SOETANTO, R., PROVERBS, D. G. & HOLT, G. D. (2001) Achieving quality construction projects based on harmonious working relationships: clients' and architects' perceptions of contractor performance, *International Journal of Quality and Reliability Management,* **18** (4/5), 528-548.

SPSS (2004) Base System: SPSS v13.0 for Windows, SPSS Inc.

STATSOFT (2004) *Cluster Analysis,* http://www.statsoft.com/textbook/stcluan.html, [28/12/06].

STRAIGHT, R. L. (1999) Measuring Contractors' Performance, *Journal of Supply Chain Management,* **35** (2), 18-28.

SULLIVAN, M. (2006) An open relationship, *Construction Journal,* **June, 06,** 9-10.

SUTRISNA, M. (2004) *Developing a knowledge based system for the valuation of variations in civil engineering works,* PhD thesis, University of Wolverhampton, Wolverhampton.

SUTRISNA, M. & POTTS, K. (2002) Analysing typical factors for the early prediction of variations, IN GREENWOOD, D. (Ed.) *18th annual ARCOM conference*, Newcastle, 1, 391-401.

SVENSSON, G. & WOOD, G. (2003) The dynamics of business ethics: a function of time and culture - cases and models, *Management Decision,* **41,** 350-361.

TAKIM, R., AKINTOYE, A. & KELLY, J. (2003) Performance measurement systems in construction, IN GREENWOOD, D. (Ed.) *19th annual ARCOM conference*, University of Brighton, ARCOM, 423-431.

TAKIM, R., AKINTOYE, A. & KELLY, J. (2004) Analysis of Performance Measurement in the Malaysian Construction Industry, IN OGUNLANA, S. O., CHAREONNGAM, C., HERABET, P. & HADIKUSUMO, B. H. W. (Eds.) *Globalization and Construction*, AIT Conference Centre, Bangkok, Thailand, 533–546.

TAM, C. M. & HARRIS, F. (1996) Model for assessing building contractors' project performance, *Engineering Construction and Architectural Management,* **3** (3), 187-204.

TAYLOR, J. C. & BOWERS, D. G. (1972) *Survey of organizations; a machine-scored standardized questionnaire instrument*, Center for Research on Utilization of Scientific Knowledge, Ann Arbor, Michigan.

THARP, B. M. (2005) *Diagnosing Organizational Culture,* http://www.haworth.com/haworth/assets/Diagnosing%20Org%20Culture.pdf, [12/12/06].

THE STRATEGIC FORUM FOR CONSTRUCTION (2003) *Integration toolkit,* http://www.strategicforum.org.uk/sfctoolkit2/home/home.html, [13/03/07].

THOMAS, R., MAROSSZEKY, M., KARIM, K., DAVIS, S. & MCGEORGE, D. (2002) The importance of project culture in achieving quality outcomes in construction, *Proceedings IGLC-10*, Gramado, Brazil.

THOMPSON, J. L. (1993) *Strategic management: awareness and change,* London; New York, Chapman & Hall, University and Professional Division.

TIJHUIS, W. (Ed.) (2001) *Culture in construction - Part of the deal?* CIB Publications.

TROCHIM, W. M. K. (2006) *Correlation,* http://www.socialresearchmethods.net/kb/statcorr.php, [02/02/07].

TROMPENAARS, F. & HAMPDEN-TURNER, C. (1997) *Riding the waves of culture: understanding cultural diversity in business,* London, Nicholas Brealey.

TROMPENAARS, F. & HAMPDEN-TURNER, C. (1999) *Riding the waves of culture: understanding cultural diversity in business,* 2nd edition, Nicholas Brealey, London.

TROMPENAARS, F. (1994) *Riding the waves of culture: understanding diversity in global business,* Irwin Professional Pub., Burr Ridge, Illinois.

TSUI, A. S. & OHLOTT, P. (1988) Multiple assessment of managerial effectiveness: Interrater agreement and consensus in effectiveness models, *Journal of Personnel Psychology,* **41**, 779-803.

TURNER, R. J. (2006) Towards a theory of project management: The nature of the project, *International Journal of Project Management,* **24** (1), 1.

UCLA Academic Technology Services (2006) *Annotated SPSS Output - Factor Analysis,* http://www.ats.ucla.edu/stat/spss/output/factor1.htm, [10/08/06].

VAN DEN BERG, P. T. & WILDEROM, C. P. (2004) Defining, Measuring, and Comparing Organisational Cultures, *Applied Psychology,* **53** (4), 570-582.

WALKER, D. H. T. (1997) Choosing an appropriate research methodology, *Construction Management & Economics,* **15** (2), 149.

WARRACK, B. J. & SINHA, M. N. (1999) Integrating safety and quality: building to achieve excellence in the workplace, *Total Quality Management,* **10** (4/5), 779.

WEEKLEY, J. A. & GIER, J. A. (1989) Ceiling in the reliability and validity of performance ratings: The case of expert raters, *Academy of Management Journal,* **32** (1), 213.

WHITE, D. & FORTUNE, J. (2002) Current practice in project management - an empirical study, *International Journal of Project Management,* **20** (1), 1.

WILDEROM, C. P. M., GLUNK, U. & MASLOWSKI, R. (2000) Organizational culture as a predictor of organisational performance, IN ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON, M. F. (Eds.) *Handbook of organizational culture and climate.* California, Sage.

WILSON, F. (1999) Organizational culture and control, *Organization Behaviour,* 101-118.

WOOD, R. & BANDURA, A. (1989) Social cognitive theory of organizational management, *Academy of Management Review,* **14** (3), 361-384.

WORLDBANK (1997) *Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development,* Environment Department, The World Bank, Washington DC.

XIAO, H. (2002) A comparative study of contractor performance based on Japanese, UK and US construction practice, *PhD thesis*, SEBE, University of Wolverhampton, Wolverhampton.

XIAO, H. & PROVERBS, D. (2002a) Construction time performance: an evaluation of contractors from Japan, the UK and the US, *Engineering Construction and Architectural Management,* **9** (2), 81-89.

XIAO, H. & PROVERBS, D. (2002b) The performance of contractors in Japan, the UK and the USA: a comparative evaluation of construction cost, *Construction Management and Economics,* **20** (5), 425-435.

XIAO, H. & PROVERBS, D. (2002c) The performance of contractors in Japan, the UK and the USA: an evaluation of construction quality, *International Journal of Quality and Reliability Management,* **19** (6/7), 672-687.

XIAO, H. & PROVERBS, D. (2003) Factors influencing contractor performance: an international investigation, *Engineering Construction and Architectural Management,* **10** (5), 322-332.

ZHANG, S. B. & LIU, A. M. M. (2006) Organisational culture profiles of construction enterprises in China, *Construction Management and Economics,* **24** (8), 817-828.

ZUO, J. & ZILLANTE, G. (2006) Project culture within construction projects - A pilot case study, *The international journal of construction management,* **6** (2), 15-29.

BIBLIOGRAPHY

ABUKHDER, J. (2003) Centre for the Built Environment (CBE) Seminar, Glasgow.

AKINSOLA, A. O., POTTS, K. F., NDEKUGRI, I. & HARRIS, F. (1997) Identification and evaluation of factors influencing variations on building projects, *International Journal of Project Management,* **15,** 263-267.

ALARCON, L. F. & MOURGUES, C. (2002) Performance Modelling for Contractor Selection, *Journal of Management in Engineering,* **18** (2), 52-60.

ALVESSON, M. (2002) *Understanding organizational culture*, SAGE, London; Thousand Oaks, Calif.

AMARATUNGA, D. & BALDRY, D. (2002) Performance measurement in facilities management and its relationships with management theory and motivation, *Facilities,* **20,** 327-336.

ANKRAH, N. A. (2003) *A Comparative Study of The Organizational Cultures of Architectural Practices and Construction Firms,* M.Sc. thesis, University of Strathclyde, Glasgow.

ARDITI, D. & LEE, D. E. (2003) Assessing the corporate service quality performance of design-build contractors using quality function deployment, *Construction Management and Economics,* **21,** 175-185.

ASHKANASY, N. M., WILDEROM, C. P. M. & PETERSON M. F. (2000) *Handbook of organizational culture*, Sage Publications.

BABA, K. (1996) Development of construction management based on regional culture, *IN* LANGFORD, D. A. & RETIK, A. (Eds.) *Vol 1; Managing the construction enterprise*, 119-128.

BALDRY, D. (1996) Client benchmarking of contractor performance, *IN* LANGFORD, D. A. & RETIK, A. (Eds.) *Vol 2; Managing the construction project and managing risk*, 72-81.

BARTHORPE, S. (2002) The Origins and Organisational Perspectives of Culture, *CIB Report*, 7-24.

BREMEN, M. & MARSHALL, N. (1998) Partnering strategies and organisational cultures in the construction industry, *IN* HUGHES, W. (Ed.) *ARCOM*, Reading, 465-476.

CHINYIO, E. A., OLOMOLAIYE, P. O., KOMETA, S. T. & HARRIS, F. C. (1998) A need based methodology for classifying construction clients and selecting contractors, *Construction Management and Economics,* **16,** 91-98.

COSTA, D. B., LIMA, H. R. & FORMOSO, C. T. (2004) Performance measurement systems for benchmarking in the Brazilian construction industry, IN: OGUNLANA, S. O., CHAREONNGAM, C., HERABET, P. & HADIKUSUMO, B. H. W. (Eds.), *Globalization and Construction,* AIT Conference Centre, Bangkok, Thailand, 1030-1039.

DESTER, W. S. & BLOCKLEY, D. I. (1995) Safety – behaviour and culture in construction, *Engineering Construction and Architectural Management,* **2,** 17.

FRANKS, A. (2001) Organisational culture - make of it what you will, *Clinician in Management,* **10,** 14-22.

HALL, M. A. & JAGGAR, D. M. (1997) Should Construction Enterprises, Working Internationally, Take Account of Cultural Differences in Culture?, *ARCOM*, Cambridge, 1-10.

HAMADA, T. (1994) Anthropology and organizational culture, *IN* HAMADA, T. & SIBLEY, W. E. (eds.) *Anthropological perspectives on organizational culture*, 9-62.

HANCOCK, M., VACHIRA-ANGSANA, K. & ROOT, D. (1997) The effects of culture on communication in multi national construction organizations: an Australian-Thai case study, *CIB report***,** 251-260.

HANDY, C. B. (2001) *The elephant and the flea: looking backwards to the future*, Hutchinson, London.

HARLOW, E. & HEARN, J. (1995) Cultural Constructions: Contrasting Theories of Organizational Culture and Gender Construction, *Gender Work and Organization,* **2,** 180.

HEARN, J. (1993) Men and Organisational Culture, *Organisations, gender and power*, Coventry, 26-31.

HOFSTEDE, G. J. (2000) Organisational Culture: Siren or Sea Cow? A Reply to Dianne Lewis, *Strategic Change,* **9,** 135-138.

HOOD, J. N. & LOGSDON, J. M. (2002) Business ethics in the NAFTA countries, *Journal of Business Research,* **55,** 883-890.

INKELES, A. & SASAKI, M. S. (1996) *Comparing nations and cultures: readings in a cross-disciplinary perspective*, Prentice Hall, Englewood Cliffs, N.J.

JACKSON, S. & HINCHLIFFE, S. (1999) Improving organisational culture through innovative development programmes, *International Journal of Health Care Quality Assurance,* **12,** 143-148.

JARVIS, R., CURRAN, J., KITCHING, J. & LIGHTFOOT, G. (2000) The use of quantitative and qualitative criteria in the measurement of performance in small firms, *Journal of Small Business and Enterprise Development,* **7,** 123-134.

KANJI, G. K. & WONG, A. (1998a) Quality culture in the construction industry, *Total Quality Management,* **9,** S133-S140.

KANJI, G. K. & WONG, A. (1998b) Quality culture in the construction industry, *IN* KANJI, G. K. (Ed.) *Total quality management: business excellence through quality culture*, Sheffield, S133-S140.

KAPLAN, R. S. & NORTON, D. P. (1996) *The balanced scorecard; Translating strategy into action*, Havard Business School Press, Boston, MA.

KIRK WALKER, S. (1996) Organisational culture: gender and the management of project teams in construction industry, *Vol 1; Team*, Paris, 219-226.

KNODE, T. & COOK, P. (2003) Evaluation of Contractor HSE Performance-The Industry at a Crossroad, *Journal of Petroleum Technology,* **55,** 26-27.

KUMAR, H. (2000) Learning organisational culture, *Management Accountant,* **35,** 774-776.

KWAN, A. Y. & OFORI, G. (2001) Chinese culture and successful implementation of partnering in Singapore's construction industry, *Construction Management and Economics,* **19,** 619-632.

LANGFORD, D. A. & MALE, S. (2001) *Strategic management in construction,* 2nd, Blackwell Science, Malden, MA.

LEWIS, D. (2000) The Usefulness of the Organisational Culture Concept: A Response to Gert Jan Hofstede's comments, *Strategic Change,* **9,** 139.

LINE, M. B. (1999) Types of organisational culture, *Library Management,* **20,** 73-75.

LIU, A. M. M. & LAI YIN, N. (1995) Performance of Chinese Contractors in Hong Kong, IN RICE, D. (Ed.) *Habitat and the high-rise: tradition and innovation.* Amsterdam, Lehigh University, 179-196.

LYNCH, R. L. & CROSS, K. F. (1995) *Measure up: yardsticks for continuous improvement,* Blackwell business, Cambridge.

MACCOBY, M. (1994) The Corporation as a Part-Culture, *IN* HAMADA, T. & SIBLEY, W. E. (Eds.) *Anthropological perspectives on organizational culture*, 267-278.

MAHMOUD, S. Y. & SCOTT, S. (2002) The development and use of key performance indicators by the UK construction industry, *IN* GREENWOOD, D. J. (Ed.) *18th Annual ARCOM Conference*, Newcastle-upon-Tyne, 2 587-594.

MARTINS, E. C. & TERBLANCHE, F. (2003) Building organisational culture that stimulates creativity and innovation, *European Journal of Innovation Management,* **6,** 64-74.

MCCAFFER, R. (1997) Assessment of Work Performance of Maintenance Contractors in Saudi Arabia, *Journal of Management in Engineering,* **13,** 91.

MCCARTHY, E. (1998) The Dynamics of Culture, Organisational Culture and Change, *Ai and Society,* **12,** 155-184.

MCLEOD, J. R. & WILSON, J. A. (1994) Corporate Culture Studies and Anthropology: An Uneasy Synthesis, *IN* HAMADA, T. & SIBLEY, W. E. (Eds.) *Anthropological perspectives on organizational culture*, 279-292.

MEIJER, S. D. & SCHAEFER, W. F. (1997) Conditions for An Optimal Safety Culture in Construction, *CIB Report*, 122-132.

MOLENAAR, K., BROWN, H., CAILE, S. & SMITH, R. (2002) Corporate Culture: A Study of Firms with Outstanding Construction Safety, *Professional Safety,* **47,** 18-27.

MORTIMER, S. (2000) how the university's construction courses are contributing to the industry's change of culture, *Construction Manager,* **6,** 11-12.

NASH, M. (1994) Is Culture "Good" in the Microcosm of the Firm", *IN* HAMADA, T. & SIBLEY, W. E. (Eds.) *Anthropological perspectives on organizational culture*, 293-300.

NEELY, A. (1999) The performance measurement revolution: why now and what next?, *International Journal of Operations & Production Management,* **19** (2), 205-228.

NEELY, A., RICHARDS, H., MILLS, J., PLATTS, K. & BOURNE, M. (1997) Designing performance measures: A structured approach, *International Journal of Operations & Production Management,* **17** (11), 1131-1152.

NG, S. T. & SKITMORE, R. M. (1999) Client and consultant perspectives of prequalification criteria, *Building and Environment,* **34,** 607-622.

NGOWI, A. B. (1997) Impact of Culture on Construction Procurement, *Journal of Construction Procurement,* **3,** 3-15.

NOLAN, R. W. (1994) Organizational Culture and the Development Crisis, *IN* HAMADA, T. & SIBLEY, W. E. (Eds.) *Anthropological perspectives on organizational culture*, 373-396.

OFORI, G. (2000) Globalization and construction industry development: research opportunities, *Construction Management and Economics,* **18,** 257-262.

OGBONNA, E. (1992) Managing Organisational Culture: Fantasy or Reality?, *Human Resource Management Journal,* **3,** 42.

OLUWOYE, J. O. & CAROLAN, C. G. (1996) Modelling Building Sub-Contractor Performance: A Case Study of the NSW Construction Industry, *CIB Report***,** 205-218.

PARKER, R. & BRADLEY, L. (2000) Organisational culture in the public sector: evidence from six organisations, *International Journal of Public Sector Management,* **13,** 125-141.

RASHID, M. Z. A., SAMBASIVAN, M. & JOHARI, J. (2003) The influence of corporate culture and organisational commitment on performance, *Journal of Management Development,* **22,** 708-728.

RAWSTRON, A. (1998) The Construction Act: changing the culture, *Structural Engineer,* **76,** 305.

REIMAN, T. & OEDEWALD, P. (2002) The assessment of organisational culture A methodological study, *Vtt Tiedotteita***,** ALL.

REYNOLDS, P. C. (1994) Corporate Culture on the Rocks, *IN* HAMADA, T. & SIBLEY, W. E. (Eds.) *Anthropological perspectives on organizational culture*, 301-310.

ROBSON, G. (1999) The Hong Kong construction worker - what safety culture?, *Safety and Health Practitioner,* **17,** 24-29.

ROOKE, J. (1997) Developing a more empirical approach to culture, attitude and motivation in construction management research: A critique and a proposal, *Journal of Construction Procurement,* **3,** 45-55.

RUSSELL, J. S. & JASELSKIS, E. J. (1992) Predicting Construction Contractor Failure prior to Contract Award, *Journal of Construction Engineering and Management,* **118,** 791.

SEYMOUR, D. E. & FELLOWS, R. F. (1999) Towards a culture of quality in the UK construction industry, *IN* OGUNLANA, S. O. (Ed.) *Profitable partnering in construction procurement*, Chiang Mai; Thailand, 511-522.

SOMMERVILLE, J. & SULAIMAN, N. F. (1997) The culture for quality within the UK construction industry: Temporal relatedness and dominance, *Total Quality Management,* **8,** S279-S285.

SPIEGEL, M. R. (1972), Schaum's outline of theory and problems of statistics. First edition, McGraw-Hill.

SUN, H. C. (2002) The relationship between organisational culture and its national culture: a case study, *International Journal of Human Resources Development and Management,* **2,** 78-96.

TAKIM, R. & AKINTOYE, A. (2002) Performance indicators for successful construction project performance, *IN* GREENWOOD, D. J. (Ed.) *18th Annual Association of Researchers in Construction Management (ARCOM) Conference*, Newcastle-upon-Tyne, 2 545-556.

TAYEB, M. (1994) Japanese managers and British culture: a comparative case study, *International Journal of Human Resource Management,* **5,** 145.

TIERNEY, C. J. (1999) An organisational culture change, *Organisations and People,* **6,** 2-9.

WILSON, E. (2000) Inclusion, exclusion and ambiguity: the role of organisational culture, *Personnel Review,* **29,** 274-303.

WONG, C. H., HOLT, G. & HARRIS, P. (2001) Multi-criteria selection or lowest price? Investigation of UK construction clients' tender evaluation preferences, *Engineering, Construction and Architectural Management,* **8,** 257-271.

XIAO, H., PROVERBS, D., SHAW, T. & HOLT, G. (2000) A new approach to comparing the performance of contractors internationally, *Association of Researchers in Construction Management*, Glasgow, 117-126.

YASAMIS, F., ARDITI, D. & MOHAMMADI, J. (2002) Asessing contractor quality performance, *Construction Management and Economics,* **20,** 211-223.

ZAIRI, M. (1992) TQM-based performance measurement: practical guidelines, Letchworth: Technical Communications.

Appendix A Details of publications

ANKRAH, N. A. & PROVERBS, D. (2004) Treading the softer areas of construction management: A critical review of culture, *In*: Khosrowshahi, F. (ed.), *Proceedings of the 20th Annual ARCOM Conference*, Edinburgh.

ANKRAH, N. A. & LANGFORD, D. A. (2005) Architects and Contractors: A comparative study of organizational cultures, Construction Management and Economics, **23** (6), 595-607.

ANKRAH, N. A. & PROVERBS, D. (2005) A framework for measuring construction project performance: overcoming key challenges of performance measurement, *In*: Khosrowshahi, F. (ed.), *Proceedings of the 21st Annual ARCOM Conference*, London.

ANKRAH, N. A., PROVERBS, D., ANTWI, A. & DEBRAH, Y. (2005a) The influence of organisational culture on contractor performance, *In*: Sullivan, K. and Kashiwagi, D.T. (eds.) *Proceedings of the 2005 CIB W92/T23/W107 International Symposium on Procurement Systems: The Impact of Cultural Differences and Systems on Construction Performance*, Las Vegas.

ANKRAH, N. A., PROVERBS, D., ANTWI, A. & DEBRAH, Y. (2005b) Factors influencing organisational culture: A construction project perspective, *In*: Egbu, C. O. and Tong, M. K. L. (eds.), *Proceedings of the PRoBE 2005 Conference*, Glasgow. [Best Paper – Runner up]

ANKRAH, N. A., PROVERBS, D., ANTWI, A. & DEBRAH, Y. (2005c) Towards a new approach for measuring the organisational culture of construction project organisations: Overcoming the methodological challenges, *In*: Egbu, C.O. and Tong, M.K.L. (eds.), *Proceedings of the PRoBE 2005 Conference*, Glasgow.

ANKRAH, N. A., PROVERBS, D. & DEBRAH, Y. (2007a) A cultural profile of construction project organisations in the UK, *23rd Annual ARCOM Conference.* Belfast, ARCOM, *(In press)*.

ANKRAH, N. A., PROVERBS, D. & DEBRAH, Y. (2007b) Improving satisfaction with construction project outcomes: the role of culture, *Construction Management and Economics 25th Anniversary Conference.* Reading, UK, Construction Management and Economics.

ANKRAH, N. A., PROVERBS, D. & DEBRAH, Y. (2007c) Factors influencing the culture of a construction project organisation: an empirical investigation, *Engineering Construction and Architectural Management, (Under review)*.

ANKRAH, N. A., PROVERBS, D. & DEBRAH, Y. (2007d) Towards a model for diagnosing the culture of a construction project organisation, *International Journal of Construction Management, (Under review)*.

Appendix B Preliminary questionnaire survey

To Whom It May Concern:

Dear Sir or Madam,

REQUEST FOR ASSISTANCE WITH RESEARCH INTO ORGANISATIONAL CULTURE

In seeking to further extend its well-established expertise in productivity and performance related issues, the Research Institute in Advanced Technologies (RIATec), University of Wolverhampton is sponsoring this PhD. research study into the influence of organisational culture on construction project performance. The research aims to deepen understanding of UK construction project performance, and the role organisational culture plays in determining project performance outcomes. The findings of this research will be utilised in the development of a tool to help contractors and other project participants assess their culture, identify orientations incompatible with good performance, so that steps can be taken to initiate and manage cultural change.

Such a study requires input from industry experts whose contribution will not only help make this research successful, but will also ensure that construction industry perspectives are central to the research and that the outcomes are relevant and responsive to the needs of construction organisations. It is in the light of this that I am seeking your contribution, as a construction industry expert, to this research by way of completing the attached form which will take no more than five minutes of your time. In return for your assistance, the findings of this survey will be fed back to you for your consideration and further input.

This research is being undertaken under the supervision of Professor David G. Proverbs, who is renowned as an authority in construction and project management, and is the head of Construction and Infrastructure Department, School of Engineering and the Built Environment, RIATec, University of Wolverhampton.

Please return the completed form in the enclosed self-addressed freepost envelope (No stamp required).

Counting on your consideration and support, I remain.

Yours faithfully,

Nii A. Ankrah

Doctoral Research Student
RIATec, University of Wolverhampton.
Tel: 01902323581
Email: nii.ankrah@wlv.ac.uk

THE INFLUENCE OF ORGANISATIONAL CULTURE ON CONSTRUCTION PROJECT PERFORMANCE

From a construction project organisation perspective, organisational culture can be defined as the characteristics of project organisations including approaches to construction, human resource policies, and the behaviour of people in project organisations. Assuming this definition;

1. Would you say that the culture of construction project organisations is reflected in the way work is undertaken on construction projects?

   Yes [ ] No [ ]

2. Would you say that the culture of construction project organisations influences project outcomes?

   Yes [ ] No [ ]

3. Would you say that different construction project organisations have significantly different organisational cultures?

   Yes [ ] No [ ]

4. Is it your perception that generally, the organisational culture of construction project organisations is one of the causes of the poor performance of the construction industry?

   Yes [ ] No [ ]

General information

Please indicate your **Position** (Optional) ....

How many **years of experience** do you have in construction? ....

Are you involved in day-to-day management of construction projects?

Yes [ ] No [ ]

Thank you for taking time to complete this brief survey. Your further contribution as an industry expert to this research by way of an interview will be extremely invaluable. Please indicate your willingness to be interviewed briefly (either face-to-face or by phone).

Yes [ ] No [ ]

Please provide appropriate contact details below:

Name..

Address...

....

.... Postcode ....

Tel ....

Email ....

Thank you for completing this survey. Please return completed form to:

Nii Amponsah Ankrah

Research Institute in Advanced Technologies

University of Wolverhampton

Room MA115, Wulfruna Street

Wolverhampton

WV1 1SB

Appendix C Interview schedule

Introduction

1. Provide a brief profile; in particular occupation, how long you have worked within the construction industry, current position within company and tenure with company?

What is organisational culture?

2. What do you understand by the term 'organisational culture'?
3. What do you value as a company? What is important to you?
4. On a typical construction project site, in what ways (in what aspects of the way the project is managed and work is undertaken) are these values manifested?
5. On the last project you were involved in personally, how would you describe the culture of the project organisation?
6. What was considered important on this project? What did the project team value?
7. How pervasive was this culture you have described? (Does it operate from the project management level down to the operative level?)
8. Compared with the parent company's culture, how tangible is the culture within the project organisation?
9. How do you deliver construction projects, through direct labour or extensive subcontracting?

What aspects of a project organisation need to be examined to see (or have a sense of) this culture?

10. In trying to investigate the culture of this project organisation, what aspects do I need to focus on to develop a sense of the culture on the project organisation?
11. Drawing from your experiences on your most recently completed construction project, what were some of the operational/day-to-day problems this project had to deal with?
12. How were some of these problems resolved?
13. Looking back over this project, were there any critical incidents you can recount?

What aspects of culture matter i.e. what aspects/attributes/dimensions of organisational culture most influence performance?

14. In your experience, what kind of culture (or specific attributes) within the project organisation leads to good performance?
15. In what ways do these attributes contribute to performance?
16. What kind of culture (or specific attributes) within the project organisation leads to poor/unsatisfactory performance?

17. In what ways do these attributes contribute to unsatisfactory performance?
Factors influencing organisational culture 18. In your opinion, what are the factors that influence the kind of culture that develops within the project organisation?
Specific dimensions 19. Leadership; client focus; process & team integration; delivering quality; and commitment to people – what was the culture like in respect of these, and how did it affect performance?
Other 20. If you were to be undertaking a similar investigation into organisational culture on construction projects, what aspects of organisational life would you focus on?

Appendix D Main questionnaire survey

Initial letter to give prior notice of questionnaire survey

Dear Sir or Madam,

An Investigation of Construction Project Culture and Performance

We would like to invite your participation in a research that seeks to deepen understanding of UK construction project performance, and the role that the culture on the project site plays in determining project performance outcomes.

Your participation will be by way of completing a questionnaire, and this letter is to give you prior notice of the questionnaire, which we will be mailing out shortly. The questionnaire will be based on one of your most recently completed construction projects, and may be completed by any member of the project management team. It will require that respondents recall their experiences on this project and use that as a basis for responding to the questions.

You are assured that the information obtained from this survey will be kept strictly CONFIDENTIAL and used for research purposes only.

If you require any further information or clarification, we will be happy to answer your questions. If you would also prefer to receive the questionnaire in another format (e.g. electronically), or would like us to send it to a specific individual in your company (e.g. a Project Manager), please do not hesitate in contacting us. Contact details are provided below.

We do appreciate that the questionnaire will take some of your valuable time. However, without your kind and expert input the ambitions of this research project will not be realised. It is our hope therefore that you will be able to assist us in this research.

Thanking you in anticipation.

Yours Sincerely,

Nii A. Ankrah

SEBE, University of Wolverhampton

Tel: 01902 32 3581

Fax: 01902 32 2743

Email: nii_a_ankrah@yahoo.co.uk

Cover letter of questionnaire survey

To Whom It May Concern:

Dear Sir or Madam,

An Investigation of Construction Project Culture and Performance

We would like to invite your participation in this research study which seeks to deepen understanding of UK construction project performance, and the role that the culture on the project site plays in determining project performance outcomes.

We will be very grateful if you (or one of your Project Managers) can complete the enclosed questionnaire and return it in the SAE enclosed. The questionnaire will require that you recall your experiences on one of your most recently completed construction project and use that as a basis for responding to the questions. Your contribution will be most invaluable. You are assured that the information obtained from this survey will be kept strictly CONFIDENTIAL and used for research purposes only. Upon request, you will receive a copy of a report detailing the results of this research.

If you require any further information or clarification, we will be pleased to answer your questions. Contact details are provided below. Alternatively you may wish to make assumptions on any matters that are unclear to you.

We do appreciate that the questionnaire will take some of your valuable time. However, without your kind and expert input the ambitions of this research project will not be realised. It is our hope therefore that you will be able to assist us in this research by completing and returning the enclosed questionnaire.

Thanking you in anticipation.

Yours Sincerely,

Nii A. Ankrah
Research Student
University of Wolverhampton.
Tel: 01902 32 3581
Fax: 01902 32 2743
Email: nii_a_ankrah@yahoo.co.uk

Enclosures (2)

School of Engineering and the Built Environment (SEBE)
University of Wolverhampton

A QUESTIONNAIRE ON CONSTRUCTION PROJECT CULTURE AND PERFORMANCE

The questionnaire is in four (4) parts. **Section A** requests personal information about you and is optional. **Section B** asks you to provide some information about your most recently completed construction project. **Section C** requests details about the performance of this project, and the last section (**Section D**) requests your opinion on the attitudes, behaviours and conditions that existed on this project.

Please answer questions to the best of your recollection.

We do appreciate that the questionnaire will take some of your valuable time. However, without your kind and expert input the ambitions of this research project can not be realised. To this end, we would like to thank you very much for your valued and kind consideration.

Please return completed questionnaire in the enclosed SAE or fax to:

Nii A. Ankrah
School of Engineering and the Built Environment (SEBE)
University of Wolverhampton
Wulfruna Street
WV1 1SB

Tel: 01902 32 3581
Fax: 01902 32 2743
Email: nii_a_ankrah@yahoo.co.uk

Section A General information (Optional)

Name of respondent:	______________________
Position of respondent:	______________________
Name of company:	______________________
Address:	______________________
Telephone: ______________	E-mail: ______________

Section B Project characteristics (most recently completed project)

Please provide a description of the most recently completed project on which you were personally involved, by providing appropriate answers to the questions below.

1. Type of project (please tick ✓ all applicable options)

Public	❑	New work	❑	Civil engineering	❑	Commercial	❑
Private	❑	Refurbishment	❑	Building	❑	Industrial	❑
		Redevelopment	❑			Housing	❑
						Infrastructure	❑
						Leisure	❑

Other (Please specify) ______________________

	Very simple				Very complex
2. How would you rate the complexity of this project?	1	2	**3**	4	5

3. What was the contract price? ______________

4. What was the proposed project duration? ______________

5. Where was the project located? (please tick ✓)

G. London	❑	Wales	❑	East Anglia	❑	North West	❑
South East	❑	West Midlands	❑	Yorkshire & Humber	❑	Scotland	❑
South West	❑	East Midlands	❑	North East	❑	N. Ireland	❑

Abroad (Please specify) ______________________

6. Have you worked with the client on other projects prior to this project? Yes ❑ No ❑

7. Please indicate the procurement approach employed for this project (please tick ✓)

Traditional lump sum competitive tendering	❑
Design & Build	❑
BOOT	❑
Partnering	❑
Management Contracting	❑
Construction Management	❑
Other approach (please specify)	______________

8. What was the designation of your company on this project? (please tick ✓)

Main Contractor	❑	Subcontractor	❑	Project Manager	❑
Consultant	❑	Supplier	❑	Other (please state)	______

9. For each of the following participants, indicate how much influence they had on the project during construction?

	No influence				Very influential
Architect	1	2	3	4	5
Civil Engineer	1	2	3	4	5
Quantity Surveyor	1	2	3	4	5
Client	1	2	3	4	5
Main Contractor	1	2	3	4	5
Project Manager	1	2	3	4	5
Others (please specify) ______	1	2	3	4	5

10. Was your company involved in the design phase of this project? Yes ❑ No ❑

11. How many workers on average, were on site on any particular day?

less than 10 ❑ 10 – 29 ❑ 30 – 199 ❑ 200 – 999 ❑ greater than 1000 ❑

12. Please rank the following objectives from 1 to 4 in order of priority on this project (1 for most important).

Cost ☐
Time ☐
Quality ☐
Health & Safety ☐
Other objectives (Please specify) ______

Section C Project performance outcomes (for the project described above)

Please give an indication of project performance by providing appropriate answers below.

Cost

1. What was the final cost of the project? ______

2. What factors accounted for the difference between the final cost and contract price?

Variations ❑ Estimation errors ❑ Reworking ❑ Poor project management ❑
Other (Please specify) ______

3. How many design variations were made? ______

Time

4. How long did it take to complete the project? ______

5. What factors account for the difference between the actual and proposed duration?

Variations ❑ Inclement weather ❑ Labour unrest ❑ Poor project management ❑
Other (Please specify) ______

6. How much was paid in Liquidated and Ascertained Damages on this project? ______

Repeat business

7. Have you taken orders from this client for new projects since the completion of this project? Yes ❑ No ❑

Quality

8. At the time of handover, to what extent was project free from apparent defects? (please tick ✓)

- ❑ the project was free from defects
- ❑ there were a few defects but the project handed over on time
- ❑ there were one or more defects that delayed handover slightly – by how many weeks? ________
- ❑ there were major defects which delayed handover substantially – by how many weeks? ________
- ❑ don't know

9. How many times were you called back during the Defects Liability Period to make good defects? __________

Health & Safety

10. How many	0	1	2	3	4 or more (please state)
a. accidents were reported	❑	❑	❑	❑	_____
b. near misses were reported	❑	❑	❑	❑	_____
c. fatalities occurred on this project	❑	❑	❑	❑	_____
d. injuries occurred on this project	❑	❑	❑	❑	_____

Productivity

	Very low				Very high
11. Please rate the overall level of labour productivity	1	2	**3**	4	5

12. How many man-hours were lost through operative absenteeism?

0 ❑ Less than 20 ❑ 20 – 99 ❑ 100 – 499 ❑ More than 500 ❑

Disputes

13. How many	0	1	2	3	4 or more (please state)
a. disputes with the client occurred on this project	❑	❑	❑	❑	_____
b. disputes with the other participants occurred	❑	❑	❑	❑	_____
c. claims remain unsettled from this project	❑	❑	❑	❑	_____

Learning/Innovation

	Very low				Very high
14. Please rate the level of organisational learning that took place on this project relative to similar projects you have undertaken	1	2	**3**	4	5
15. Please rate the level of innovation on this project relative to similar projects you have undertaken	1	2	**3**	4	5

Satisfaction

	Very dissatisfied				Very satisfied
16. In your opinion, how satisfied was the client with:					
a. Service	1	2	**3**	4	5
b. Cost	1	2	**3**	4	5
c. Time	1	2	**3**	4	5
d. Quality	1	2	**3**	4	5
17. How satisfied were operatives with:					
a. Site conditions and welfare facilities	1	2	**3**	4	5
b. Wages	1	2	**3**	4	5
18. How satisfied was your company with the level of profitability of this project?	1	2	**3**	4	5
19. How satisfied was management with the level of collaboration and harmony between project participants?	1	2	**3**	4	5

Section D The culture

Attitudes and perceptions

From your experience on the project described, please indicate the extent to which the following items were considered important. Choose **Very important** only for those items which were most important and were specifically emphasised.

Leadership	No importance				Utmost importance
In respect of the site workforce, how important was it to project management:					
a. for managers to be approachable and accessible	1	2	**3**	4	5
b. to be helpful and to convey appreciation	1	2	**3**	4	5
c. to regulate the behaviour of workers	1	2	**3**	4	5
d. that operatives had a say in what went on	1	2	**3**	4	5
e. to let operatives know what was going on with the rest of the project	1	2	**3**	4	5
f. to talk to operatives to find out what was going on at their level	1	2	**3**	4	5
Client	No importance				Utmost importance
How important was it to the project organisation:					
a. to have lots of contact and communication with the client	1	2	**3**	4	5
b. to carry out research into end-user's wants/needs	1	2	**3**	4	5
c. to educate the client on the construction project and processes	1	2	**3**	4	5
d. to monitor the satisfaction of the client	1	2	**3**	4	5
e. to put the client's needs ahead of the needs of all other participants	1	2	**3**	4	5
f. to respect the client	1	2	**3**	4	5
Team	No importance				Utmost importance
How important was it within the project organisation:					
a. that people worked collaboratively	1	2	**3**	4	5
b. to be suspicious of other workers who belong to other trades/companies	1	2	**3**	4	5
c. to emphasise teamwork and involve all participants in planning	1	2	**3**	4	5
d. to deal with conflict by compromise	1	2	**3**	4	5
e. for participants to withhold information from each other	1	2	**3**	4	5
f. for workers to identify more with their companies than the project	1	2	**3**	4	5
g. to have open and free communications	1	2	**3**	4	5
h. to find a participant to blame when things went wrong	1	2	**3**	4	5
Project delivery	No importance				Utmost importance
How important within the project organisation was it:					
a. to encourage people to try new things	1	2	**3**	4	5
b. to learn from good practice and to learn from mistakes	1	2	**3**	4	5
c. to keep track of performance	1	2	**3**	4	5
d. to provide feedback on performance to all project participants	1	2	**3**	4	5
e. to accept that waste was unavoidable	1	2	**3**	4	5
f. to believe that this project could be delivered on time	1	2	**3**	4	5
g. to believe that this project could be delivered within budget	1	2	**3**	4	5
h. to believe that this project could achieve very high quality standards	1	2	**3**	4	5
i. not to damage the environment during construction	1	2	**3**	4	5
Workforce	No importance				Utmost importance
How important was it for the project organisation:					
a. to use only direct employees on this project	1	2	**3**	4	5
b. to show commitment to, and concern for all workers on site	1	2	**3**	4	5
c. that all workers were respected	1	2	**3**	4	5
d. to keep workers well motivated	1	2	**3**	4	5
e. to provide training opportunities	1	2	**3**	4	5
f. that the health and safety of workforce and public was safeguarded	1	2	**3**	4	5
g. that the site was tidy	1	2	**3**	4	5
h. that performance of workers was recognised	1	2	**3**	4	5

Behaviours

On the project described in Section B, please indicate the extent to which you agree that the following behaviours were present. Choose **Strongly agree** only for those behaviours towards which conscious effort was made on this project.

Leadership	Strongly disagree				Strongly agree
On this project:					
a. managers were distant and not approachable	1	2	3	4	5
b. managers always conveyed appreciation for the efforts of operatives	1	2	3	4	5
c. managers strictly regulated the behaviour of operatives	1	2	3	4	5
d. operatives had little say in how the project was run	1	2	3	4	5
e. operatives were kept continuously informed of what was going on	1	2	3	4	5
f. managers rarely talked to operatives to find out progress at their level	1	2	3	4	5
Client	Strongly disagree				Strongly agree
During this project:					
a. there was very little contact or communication with the client	1	2	3	4	5
b. participants carried out extensive research into end-user needs	1	2	3	4	5
c. the client was kept educated on the project and its processes	1	2	3	4	5
d. the satisfaction of the client was monitored at all times	1	2	3	4	5
e. other considerations were put first before the client's needs	1	2	3	4	5
f. the client was shown little respect	1	2	3	4	5
Team	Strongly disagree				Strongly agree
During this project:					
a. different workgroups, gangs and companies worked collaboratively	1	2	3	4	5
b. project participants had complete trust in each other	1	2	3	4	5
c. there was participation and input from all participants	1	2	3	4	5
d. disagreements were resolved by discussion and compromise	1	2	3	4	5
e. some participants withheld information required by other participants	1	2	3	4	5
f. people identified more with their own companies than with the project	1	2	3	4	5
g. people could speak freely and openly	1	2	3	4	5
h. participants were quick to blame others when a problem occurred	1	2	3	4	5
Project delivery	Strongly disagree				Strongly agree
On this project, participants:					
a. were very creative and tried new ways of carrying out their jobs	1	2	3	4	5
b. availed themselves of any opportunities to learn something new	1	2	3	4	5
c. were continuously assessed on their performance	1	2	3	4	5
d. received little or no feedback on the quality of their work	1	2	3	4	5
e. worked hard to eliminate waste and processes which did not add value	1	2	3	4	5
f. put in little effort to deliver the project on schedule	1	2	3	4	5
g. were mindful of cost and worked to drive down costs	1	2	3	4	5
h. were apathetic towards ensuring that high quality levels were achieved	1	2	3	4	5
i. executed their work in environmentally friendly ways	1	2	3	4	5
Workforce	Strongly disagree				Strongly agree
On this project:					
a. a lot of the work was subcontracted	1	2	3	4	5
b. managers showed little concern for the welfare of workers	1	2	3	4	5
c. managers treated operatives with little respect	1	2	3	4	5
d. workers at all levels were given adequate responsibility and incentives	1	2	3	4	5
e. people actively took part in any training sessions organised on site	1	2	3	4	5
f. operatives did not use the provided PPE gear	1	2	3	4	5
g. workers always cleaned up their work area and kept the site tidy	1	2	3	4	5
h. operatives who worked hard were recognised and rewarded accordingly	1	2	3	4	5

Situational context

On the project described in Section B, please indicate the extent to which you agree that the following conditions were present on site. Choose **Strongly agree** only for those conditions which were consciously promoted on this project.

Leadership	Strongly disagree				Strongly agree
On this project, there were specific systems and procedures:					
a. to restrict access of operatives to managers and project leaders	1	2	3	4	5
b. which required managers to be supportive and always convey appreciation	1	2	3	4	5
c. for regulating behaviours such as dressing, punctuality and language	1	2	3	4	5
d. to ensure that operatives at all levels had a say in how the job was done	1	2	3	4	5
e. to ensure that all operatives knew how the whole project was progressing	1	2	3	4	5
f. to facilitate two-way interaction between managers and operatives	1	2	3	4	5

Client	Strongly disagree				Strongly agree
The project arrangements were such that:					
a. there was limited access to the client to discuss project-related issues	1	2	3	4	5
b. participants were always able to check the client's wants/needs	1	2	3	4	5
c. there were opportunities to educate the client on project delivery process	1	2	3	4	5
d. there were systems and procedures for monitoring client satisfaction	1	2	3	4	5
e. participants could prioritise their own needs ahead of the client's needs	1	2	3	4	5
f. respect for the client was emphasised throughout the project organisation	1	2	3	4	5

Team	Strongly disagree				Strongly agree
The project arrangements were such that:					
a. participants were collocated in the same site accommodation and shared the same facilities	1	2	3	4	5
b. there was an 'open-book' policy between participants	1	2	3	4	5
c. all participants had opportunities to participate in goal-setting	1	2	3	4	5
d. there were clear procedures for managing disagreements and disputes	1	2	3	4	5
e. all the project information required was readily available and accessible	1	2	3	4	5
f. instead of having only company logos displayed, all working gear, plant & equipment also had project logos	1	2	3	4	5
g. they facilitated regular interaction and open communications	1	2	3	4	5
h. there were punitive measures for participants who made mistakes	1	2	3	4	5

Project delivery	Strongly disagree				Strongly agree
The project arrangements were such that there were:					
a. incentives for developing creative new ways of carrying out work	1	2	3	4	5
b. 'lessons learned' workshops to learn from what was going right or wrong	1	2	3	4	5
c. specific key performance indicators that were measured continuously	1	2	3	4	5
d. clear procedures for providing feedback to participants	1	2	3	4	5
e. barriers to the removal of waste and processes which did not add value	1	2	3	4	5
f. measures to ensure that more effort was put into delivering project on time	1	2	3	4	5
g. initiatives to make participants think about cost and strive to drive it down	1	2	3	4	5
h. initiatives to make people think about quality and getting it right first time	1	2	3	4	5
i. clear policies on the environment and working sustainably	1	2	3	4	5

Workforce	Strongly disagree				Strongly agree
The project arrangements were such that:					
a. most of the workers were direct employees of the contractor	1	2	3	4	5
b. satisfactory facilities (canteen, medical, etc.) were provided for workers	1	2	3	4	5
c. there were clear requirements for all operatives to be treated with respect	1	2	3	4	5
d. workers had more time for personal/family life	1	2	3	4	5
e. there were regular training sessions for participants	1	2	3	4	5
f. there were clear policies for people at all levels to intervene when they saw others working unsafely	1	2	3	4	5
g. there were clear rules about keeping work areas clean and tidy	1	2	3	4	5
h. there were incentive schemes and award ceremonies to reward hard work	1	2	3	4	5

THIS IS THE END OF THE QUESTIONNAIRE – THANK YOU FOR YOUR TIME

Appendix E Calculation of the margin of error

The margin of error is given by the expression:

$$m = z^{*}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Where:

m = margin of error

z^{*} = standard random variable

$\hat{p}$ = estimated variance

n = sample size

For a significance level of $\alpha = 0.05$, $z^{*} = 1.96$.

When estimating the margin of error, it was assumed that maximum variance occurs when p = 0.5 which provides the worst case scenario (Sutrisna, 2004).

Based on this assumption, the margin of error was computed as follows:

$$m = 1.96\sqrt{\frac{0.5(1-0.5)}{85}} \times 100\%$$

$$m = 1.96 \times 0.05423 \times 100\%$$

$$m = 10.63\%$$

Appendix F Missing Value Analysis

	N	Mean	Std. Deviation	Missing		No. of Extremes(a,b)		Summary of Estimated Means		
				Count	%	Low	High	All Values	EM	Regression
Complexity	64	3.27	.877	0	.0	0	0	3.27	3.27	3.27
Con_Price	62	4.8127	13.09048	2	3.1	0	7	4.8127	4.8221	4.9796
Proj_Dur	61	12.1311	10.84720	3	4.7	0	2	12.1311	11.5036	12.1367
Infl_arch	57	3.09	1.467	7	10.9	0	0	3.09	3.05	3.01
Infl_ce	53	2.66	1.300	11	17.2	0	0	2.66	2.71	2.62
Infl_qs	57	2.77	1.239	7	10.9	0	0	2.77	2.67	2.80
Infl_client	60	3.82	1.112	4	6.3	0	0	3.82	3.99	3.86
Infl_mc	55	4.36	.847	9	14.1	1	0	4.36	4.25	4.29
Infl_pm	51	3.51	1.362	13	20.3	0	0	3.51	3.35	3.50
Prior_cost	63	2.29	1.099	1	1.6	0	0	2.29	2.27	2.27
Prior_time	63	2.84	1.167	1	1.6	0	0	2.84	2.82	2.86
Prior_qual	63	2.05	1.023	1	1.6	0	0	2.05	2.03	2.04
Prior_hands	63	1.90	1.174	1	1.6	0	0	1.90	1.90	1.89
Act_cost	58	3.37869	4.675395	6	9.4	0	6	3.37869	2.94209	3.25118
Var	39	36.62	63.851	25	39.1	0	4	36.62	27.33	37.28
Act_dur	62	12.1129	9.40926	2	3.1	0	1	12.1129	12.0014	12.2873
LAD	34	1.4853	5.61449	30	46.9	.	.	1.4853	1.9507	.8603
Delay	6	2.1667	.75277	58	90.6	0	0	2.1667	2.5613	2.1771
DLP	31	2.81	5.108	33	51.6	0	2	2.81	1.91	2.68
Acc_rep	61	1.03	1.622	3	4.7	0	9	1.03	.51	1.03
Near_misses	54	.70	1.656	10	15.6	0	5	.70	.88	.63
Fatalities	56	.00	.000	8	12.5	.	.	.00	.00	.00
Injuries	55	.82	1.362	9	14.1	0	9	.82	.80	.80
Prod	59	3.68	.706	5	7.8	0	0	3.68	3.61	3.69
Disp_client	63	.51	1.469	1	1.6	.	.	.51	.52	.53
Disp_others	59	.54	.877	5	7.8	0	4	.54	.55	.57
Claims	58	.19	.512	6	9.4	.	.	.19	.20	.18
Learn	50	3.02	.958	14	21.9	0	0	3.02	3.15	3.03
Innov	51	2.76	.951	13	20.3	0	1	2.76	2.71	2.79
Sat_serv	64	4.27	.740	0	.0	1	0	4.27	4.25	4.27
Sat_cost	64	4.05	.825	0	.0	2	0	4.05	4.05	4.05
Sat_time	64	4.09	.904	0	.0	4	0	4.09	4.11	4.09
Sat_qual	64	4.30	.683	0	.0	0	0	4.30	4.29	4.30
Sat_fac	63	4.02	.751	1	1.6	0	0	4.02	4.00	4.02
Sat_wages	60	3.73	.710	4	6.3	0	0	3.73	3.72	3.74
Sat_prof	52	3.46	.979	12	18.8	3	0	3.46	3.29	3.46
Sat_harm	64	3.95	.844	0	.0	0	0	3.95	3.94	3.95
CAL1	63	4.32	.737	1	1.6	1	0	4.32	4.33	4.32
CAL2	63	4.00	.672	1	1.6	.	.	4.00	4.00	4.01
CAL3	62	3.90	.824	2	3.1	0	0	3.90	3.92	3.93
CAL4	63	3.21	1.003	1	1.6	3	0	3.21	3.20	3.20
CAL5	63	3.56	.996	1	1.6	3	0	3.56	3.57	3.57
CAL6	63	3.49	1.045	1	1.6	3	0	3.49	3.47	3.50
CAC1	63	4.13	1.024	1	1.6	5	0	4.13	4.10	4.13
CAC2	63	3.84	1.153	1	1.6	0	0	3.84	3.82	3.83
CAC3	61	3.34	1.063	3	4.7	4	0	3.34	3.39	3.37
CAC4	62	4.11	.889	2	3.1	2	0	4.11	4.15	4.11
CAC5	62	3.69	.985	2	3.1	2	0	3.69	3.73	3.73
CAC6	62	4.37	.927	2	3.1	2	0	4.37	4.37	4.38
CAT1	63	4.43	.665	1	1.6	0	0	4.43	4.43	4.43
CAT2	61	3.85	1.123	3	4.7	0	0	3.85	3.87	3.85
CAT3	62	3.89	.870	2	3.1	1	0	3.89	3.89	3.89
CAT4	58	3.41	1.044	6	9.4	3	0	3.41	3.42	3.40
CAT5	59	4.34	.976	5	7.8	4	0	4.34	4.39	4.33

	N	Mean	Std. Deviation	Missing		No. of Extremes(a,b)		Summary of Estimated Means		
				Count	%	Low	High	All Values	EM	Regression
CAT6	59	3.68	1.041	5	7.8	0	0	3.68	3.71	3.66
CAT7	62	3.98	.983	2	3.1	0	0	3.98	3.97	4.02
CAT8	50	1.62	.945	14	21.9	0	2	1.62	1.66	1.65
CAP1	61	2.85	.963	3	4.7	0	1	2.85	2.84	2.90
CAP2	64	4.13	.864	0	.0	3	0	4.13	4.11	4.13
CAP3	63	4.16	.677	1	1.6	0	0	4.16	4.18	4.17
CAP4	62	3.66	.886	2	3.1	1	0	3.66	3.71	3.67
CAP5	62	3.29	1.220	2	3.1	5	0	3.29	3.29	3.25
CAP6	61	4.07	.981	3	4.7	4	0	4.07	4.09	4.09
CAP7	62	3.89	1.010	2	3.1	0	0	3.89	3.86	3.88
CAP8	62	4.32	.883	2	3.1	4	0	4.32	4.32	4.31
CAP9	52	3.79	1.016	12	18.8	0	0	3.79	3.84	3.81
CAW1	64	3.27	1.324	0	.0	0	0	3.27	3.24	3.27
CAW2	63	4.02	.852	1	1.6	2	0	4.02	4.01	4.02
CAW3	63	4.08	.848	1	1.6	2	0	4.08	4.07	4.09
CAW4	63	4.06	.780	1	1.6	.	.	4.06	4.06	4.07
CAW5	63	3.78	1.039	1	1.6	3	0	3.78	3.77	3.78
CAW6	64	4.55	.733	0	.0	1	0	4.55	4.54	4.55
CAW7	64	4.23	.771	0	.0	1	0	4.23	4.22	4.23
CAW8	63	3.83	.853	1	1.6	2	0	3.83	3.83	3.81
CBL1	61	4.34	.998	3	4.7	3	0	4.34	4.33	4.34
CBL2	63	3.65	.919	1	1.6	2	0	3.65	3.68	3.66
CBL3	61	3.30	1.022	3	4.7	4	0	3.30	3.32	3.30
CBL4	60	3.43	1.047	4	6.3	0	0	3.43	3.34	3.38
CBL5	60	3.33	.857	4	6.3	3	0	3.33	3.48	3.38
CBL6	59	3.95	1.041	5	7.8	0	0	3.95	3.73	3.99
CBC1	61	4.31	1.133	3	4.7	7	0	4.31	4.22	4.31
CBC2	62	3.45	1.155	2	3.1	3	0	3.45	3.45	3.43
CBC3	61	3.80	1.108	3	4.7	0	0	3.80	3.80	3.82
CBC4	61	3.92	1.021	3	4.7	5	0	3.92	3.92	3.94
CBC5	61	3.95	1.117	3	4.7	0	0	3.95	3.97	3.95
CBC6	61	4.67	.870	3	4.7	.	.	4.67	4.68	4.71
CBT1	60	3.85	.954	4	6.3	0	0	3.85	3.85	3.85
CBT2	63	3.63	.848	1	1.6	1	0	3.63	3.64	3.63
CBT3	60	3.62	.825	4	6.3	1	0	3.62	3.63	3.63
CBT4	61	3.72	.951	3	4.7	2	0	3.72	3.70	3.70
CBT5	60	3.85	.971	4	6.3	0	0	3.85	3.88	3.81
CBT6	60	3.27	.918	4	6.3	1	0	3.27	3.32	3.26
CBT7	62	3.87	.799	2	3.1	1	0	3.87	3.90	3.87
CBT8	62	2.31	1.095	2	3.1	0	0	2.31	2.30	2.31
CBP1	62	3.13	.914	2	3.1	4	0	3.13	3.11	3.14
CBP2	60	3.13	.833	4	6.3	1	0	3.13	3.15	3.15
CBP3	62	3.21	.771	2	3.1	1	0	3.21	3.22	3.21
CBP4	62	3.73	.908	2	3.1	0	0	3.73	3.69	3.73
CBP5	60	3.35	.880	4	6.3	0	0	3.35	3.34	3.34
CBP6	62	4.08	.980	2	3.1	6	0	4.08	4.04	4.09
CBP7	60	3.38	.825	4	6.3	0	0	3.38	3.37	3.39
CBP8	61	3.82	1.118	3	4.7	0	0	3.82	3.75	3.79
CBP9	52	3.38	.771	12	18.8	1	0	3.38	3.29	3.38
CBW1	60	3.68	1.157	4	6.3	0	0	3.68	3.65	3.70
CBW2	60	4.52	.725	4	6.3	2	0	4.52	4.51	4.49
CBW3	60	4.42	.962	4	6.3	3	0	4.42	4.41	4.43
CBW4	61	3.56	.719	3	4.7	0	0	3.56	3.58	3.54
CBW5	60	3.65	.899	4	6.3	1	0	3.65	3.63	3.65
CBW6	59	4.19	1.042	5	7.8	6	0	4.19	4.10	4.19
CBW7	62	3.32	1.083	2	3.1	3	0	3.32	3.26	3.32
CBW8	61	3.44	.922	3	4.7	1	0	3.44	3.47	3.44
CSL1	60	4.37	.901	4	6.3	3	0	4.37	4.43	4.33
CSL2	60	3.40	.887	4	6.3	2	0	3.40	3.40	3.39
CSL3	60	3.23	1.110	4	6.3	5	0	3.23	3.16	3.24

	N	Mean	Std. Deviation	Missing		No. of Extremes(a,b)		Summary of Estimated Means		
				Count	%	Low	High	All Values	EM	Regression
CSL4	60	2.92	.889	4	6.3	0	0	2.92	2.91	2.93
CSL5	61	3.25	.925	3	4.7	2	0	3.25	3.19	3.27
CSL6	60	3.43	.927	4	6.3	3	0	3.43	3.43	3.46
CSC1	60	4.05	1.185	4	6.3	0	0	4.05	4.07	4.00
CSC2	62	3.66	.922	2	3.1	2	0	3.66	3.66	3.64
CSC3	60	3.52	1.000	4	6.3	3	0	3.52	3.58	3.57
CSC4	59	3.58	1.070	5	7.8	2	0	3.58	3.57	3.55
CSC5	60	3.68	1.017	4	6.3	0	0	3.68	3.67	3.68
CSC6	61	4.03	.894	3	4.7	3	0	4.03	4.01	4.01
CST1	58	3.53	1.354	6	9.4	0	0	3.53	3.54	3.49
CST2	59	3.44	1.071	5	7.8	2	0	3.44	3.50	3.43
CST3	61	3.23	1.071	3	4.7	3	0	3.23	3.26	3.25
CST4	60	3.48	1.112	4	6.3	2	0	3.48	3.51	3.50
CST5	60	3.57	1.015	4	6.3	2	0	3.57	3.57	3.58
CST6	59	2.63	1.325	5	7.8	0	0	2.63	2.66	2.75
CST7	61	3.46	.886	3	4.7	2	0	3.46	3.45	3.46
CST8	51	2.24	1.069	13	20.3	0	0	2.24	2.16	2.25
CSP1	58	2.66	.928	6	9.4	0	2	2.66	2.55	2.66
CSP2	59	2.92	1.005	5	7.8	0	0	2.92	2.85	2.93
CSP3	59	3.00	1.050	5	7.8	0	0	3.00	2.92	3.02
CSP4	58	3.16	.951	6	9.4	2	0	3.16	3.10	3.17
CSP5	59	3.44	.915	5	7.8	0	0	3.44	3.43	3.47
CSP6	59	3.64	.783	5	7.8	0	0	3.64	3.59	3.62
CSP7	59	3.17	.834	5	7.8	1	0	3.17	3.11	3.19
CSP8	61	3.69	.847	3	4.7	0	0	3.69	3.67	3.68
CSP9	50	3.58	.992	14	21.9	1	0	3.58	3.38	3.56
CSW1	62	3.26	1.330	2	3.1	0	0	3.26	3.19	3.26
CSW2	61	4.11	.933	3	4.7	3	0	4.11	4.10	4.11
CSW3	60	3.72	1.010	4	6.3	3	0	3.72	3.69	3.72
CSW4	60	2.92	.979	4	6.3	0	4	2.92	2.94	2.91
CSW5	57	3.30	1.085	7	10.9	2	0	3.30	3.26	3.31
CSW6	60	3.93	.918	4	6.3	0	0	3.93	3.93	3.95
CSW7	61	4.02	.885	3	4.7	4	0	4.02	3.99	4.03
CSW8	60	2.67	1.230	4	6.3	0	7	2.67	2.59	2.71
Proj_type1	56			8	12.5					
Proj_type2	56			8	12.5					
Proj_type3	54			10	15.6					
Proj_type4	53			11	17.2					
Proj_loc	64			0	.0					
Prev_wk	63			1	1.6					
Proc_route	64			0	.0					
Role	64			0	.0					
Most_infl	59			5	7.8					
Involve_des	61			3	4.7					
wkrs_on_site	64			0	.0					
Other_obj	4			60	93.8					
Fact_var	64			0	.0					
Fact_est	64			0	.0					
Fact_rewkg	64			0	.0					
Fact_prjmgt	64			0	.0					
other_fact	63			1	1.6					
Fact_var2	64			0	.0					
Fact_wea	64			0	.0					
Fact_lab	64			0	.0					
Fact_prjmgt2	64			0	.0					
Other	64			0	.0					
Rep_wk	63			1	1.6					
Defects	63			1	1.6					
Absent	57			7	10.9					

a Number of cases outside the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR). b . indicates that the inter-quartile range (IQR) is zero.

Appendix G Project types covered in survey

Table 1 Descriptive statistics of project characteristics

	N	Minimum	Maximum	Sum	%
Contract price (million)	64	0.015	100	308.0123	
All Proj_type1	56	.02	18.00	194.70	
Public Contract price (million)	24	0.495	18	117.7594	60.48
Private Contract price (million)	32	0.015	18	76.9405	39.52
All Proj_type2	56	.02	18.00	181.92	
New wk Contract price (million)	34	0.0263	18	136.275	74.91
Refurb Contract price (million)	16	0.015	7.2	23.6237	12.99
Redev Contract price (million)	5	0.0154	11.5	17.7133	9.74
Demo Contract price (million)	1	4.3124	4.3124	4.3124	2.37
All Proj_type3	54	.02	100.00	268.60	
Civils Contract price (million)	10	0.7	100	149.3027	55.59
Building Contract price (million)	44	0.0154	18	119.2942	44.41
All Proj_type4	53	.02	18.00	171.92	
Comm Contract price (million)	13	0.2	10	39.92	23.22
Industrial Contract price (million)	7	0.015	4.3124	10.4497	6.08
Housing Contract price (million)	13	0.05	8.5	23.6379	13.75
Infra Contract price (million)	6	0.495	18	59.6077	34.67
Leisure Contract price (million)	3	0.581	0.95	2.281	1.33
Education Contract price (million)	3	1.2	4.8127	7.8127	4.54
Mixed Contract price (million)	6	0.0154	4.2	11.3654	6.61
Health Contract price (million)	2	0.85	16	16.85	9.80

Table 2 Project complexity statistics

Complexity

N	Valid	64
	Missing	0
Mean		3.27
Std. Error of Mean		.110
Median		3.00
Mode		3
Std. Deviation		.877
Skewness		.174
Std. Error of Skewness		.299
Kurtosis		-.656
Std. Error of Kurtosis		.590
Minimum		2
Maximum		5

Table 3 Chi-square test results for distribution of procurement routes

Proc_route

	Observed N	Expected N	Residual
Traditional	26	7.1	18.9
Design & Build	19	7.1	11.9
Partnering	13	7.1	5.9
Management Contracting	1	7.1	-6.1
Construction Management	1	7.1	-6.1
Remeasurement	1	7.1	-6.1
NEC	1	7.1	-6.1
EMAC	1	7.1	-6.1
PFI	1	7.1	-6.1
Total	64		

Test Statistics

	Proc_route
Chi-Square[a]	106.438
df	8
Asymp. Sig.	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 7.1.

Descriptive Statistics

Variables : Contract price (million)
Statistics : Sum
Stat Type : Statistic

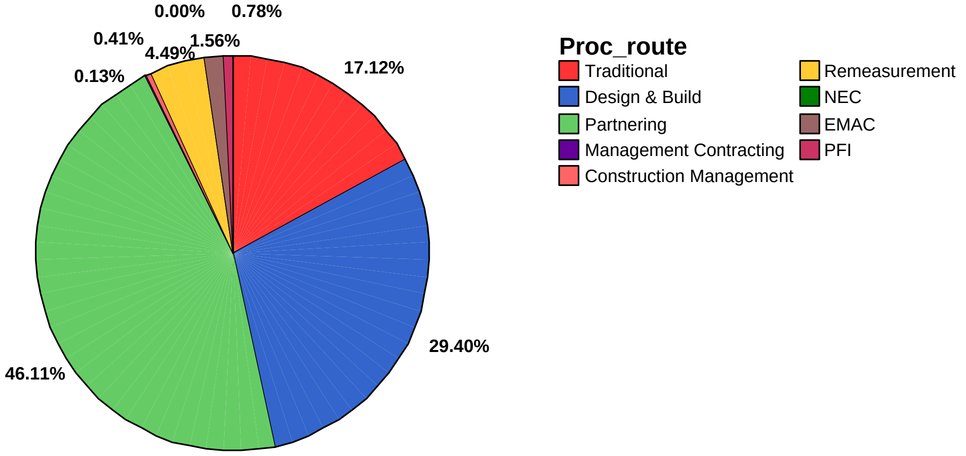

Figure 1 Proportion of contract sum for different procurement routes

Table 4 Frequency distribution of banded contract prices

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= .20	10	15.6	15.6	15.6
	.21 - .49	9	14.1	14.1	29.7
	.50 - .85	9	14.1	14.1	43.8
	.86 - 2.00	9	14.1	14.1	57.8
	2.01 - 4.20	9	14.1	14.1	71.9
	4.21 - 8.00	9	14.1	14.1	85.9
	8.01+	9	14.1	14.1	100.0
	Total	64	100.0	100.0	

Table 5 Frequency distribution of banded project durations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= 4.50	10	15.6	15.6	15.6
	4.51 - 7.00	10	15.6	15.6	31.3
	7.01 - 9.00	11	17.2	17.2	48.4
	9.01 - 12.00	6	9.4	9.4	57.8
	12.01 - 14.00	9	14.1	14.1	71.9
	14.01 - 18.00	11	17.2	17.2	89.1
	18.01+	7	10.9	10.9	100.0
	Total	64	100.0	100.0	

Table 6 Descriptive statistics of number of workers on site

N	Valid	64
	Missing	0
Mean		2.02
Std. Error of Mean		.108
Median		2.00
Mode		2
Std. Deviation		.864
Skewness		.427
Std. Error of Skewness		.299
Kurtosis		-.578
Std. Error of Kurtosis		.590
Minimum		1
Maximum		4

Table 7 Cross-tabulation of procurement approach and involvement in design

		Proc_route								
		Traditional	Design & Build	Partnering	Management Contracting	Construction Management	Remeasurement	NEC	EMAC	PFI
Involve_des	Yes	5	17	11	0	0	0	0	1	0
	No	19	2	1	1	1	1	1	0	1

Table 8 Nonparametric bivariate correlations between project characteristics

			Proj_type1	Proj_type2b	Proj_type3	Proj_type4b	Complexity	Contract price	Project duration	Prev_wk	Infl_arch	Infl_ce	Infl_qs	Infl_client	Infl_mc	Infl_pm	Involve_des	wkrs_on_site	Prior_cost	Prior_time	Prior_qual	Prior_hands	Act_cost	Var	Act_dur	LAD
Spearman's rho	Proj_type1	Corr Coeff	1.000	0.204	0.285	-0.207	-0.192	***-0.452*****	***-0.451*****	0.120	-0.213	-0.277	***-0.520*****	0.034	-0.066	-0.122	0.017	***-0.385*****	0.128	-0.139	-0.144	-0.136	***-0.458*****	-0.218	***-0.495*****	0.102
		Sig. (2-tailed)	.	0.152	0.052	0.163	0.156	***0.000***	***0.000***	0.383	0.137	0.065	***0.000***	0.811	0.658	0.419	0.904	***0.003***	0.347	0.306	0.288	0.317	***0.000***	0.106	***0.000***	0.579
		N	56	51	47	47	56	***56***	***56***	55	50	45	***49***	53	48	46	54	***56***	56	56	56	56	***56***	56	***56***	32
	Proj_type2b	Corr Coeff	0.204	1.000	0.026	-0.108	-0.005	***-0.327****	***-0.264****	-0.020	-0.151	-0.043	0.131	-0.004	0.018	-0.019	0.037	-0.253	0.125	-0.090	-0.232	-0.075	***-0.281****	-0.175	***-0.289****	-0.011
		Sig. (2-tailed)	0.152	.	0.858	0.452	0.972	***0.014***	***0.050***	0.885	0.302	0.776	0.364	0.977	0.900	0.901	0.789	0.060	0.361	0.511	0.085	0.585	***0.036***	0.197	***0.031***	0.953
		N	51	56	50	51	56	***56***	***56***	55	49	47	50	52	49	44	54	56	56	56	56	56	***56***	56	***56***	32
	Proj_type3	Corr Coeff	0.285	0.026	1.000	-0.153	-0.044	***-0.366*****	-0.237	0.040	***0.390*****	***-0.528*****	-0.230	-0.198	-0.173	-0.262	0.051	-0.256	-0.163	-0.139	-0.072	-0.167	***-0.291****	0.114	-0.185	***-0.380****
		Sig. (2-tailed)	0.052	0.858	.	0.285	0.754	***0.007***	0.084	0.774	***0.005***	***0.000***	0.108	0.155	0.228	0.082	0.716	0.061	0.238	0.318	0.605	0.228	***0.033***	0.414	0.180	***0.042***
		N	47	50	54	51	54	***54***	54	53	***50***	***47***	50	53	50	45	53	54	54	54	54	54	***54***	54	54	***29***
	Proj_type4b	Corr Coeff	-0.207	-0.108	-0.153	1.000	0.141	0.162	-0.089	-0.233	-0.240	0.029	-0.111	0.099	-0.044	-0.168	-0.148	***0.279****	***-0.277****	-0.034	0.218	-0.050	0.153	-0.059	-0.119	0.049
		Sig. (2-tailed)	0.163	0.452	0.285	.	0.314	0.246	0.526	0.096	0.104	0.852	0.451	0.493	0.770	0.286	0.302	***0.043***	***0.045***	0.807	0.116	0.723	0.273	0.673	0.396	0.801
		N	47	51	51	53	53	53	53	52	47	45	48	50	47	42	51	***53***	***53***	53	53	53	53	53	53	29
	Complexity	Corr Coeff	-0.192	-0.005	-0.044	0.141	1.000	***0.409*****	***0.421*****	-0.174	0.151	***0.306****	0.187	-0.011	-0.176	-0.128	-0.183	***0.345*****	0.134	-0.183	0.197	-0.053	***0.434*****	***0.403*****	***0.473*****	0.094
		Sig. (2-tailed)	0.156	0.972	0.754	0.314	.	***0.001***	***0.001***	0.172	0.263	***0.026***	0.164	0.931	0.199	0.372	0.158	***0.005***	0.292	0.147	0.119	0.680	***0.000***	***0.001***	***0.000***	0.597
		N	56	56	54	53	64	***64***	***64***	63	57	***53***	57	60	55	51	61	***64***	64	64	64	64	***64***	***64***	***64***	34
	Contract price (million)	Corr Coeff	***-0.452*****	***-0.327****	***-0.366*****	0.162	***0.409*****	1.000	***0.828*****	-0.114	0.041	***0.622*****	***0.480*****	0.090	-0.142	0.079	-0.236	***0.798*****	-0.004	0.007	0.309	-0.051	***0.973*****	***0.506*****	***0.760*****	0.109
		Sig. (2-tailed)	***0.000***	***0.014***	***0.007***	0.246	***0.001***	.	***0.000***	0.374	0.759	***0.000***	***0.000***	0.493	0.303	0.583	0.067	***0.000***	0.975	0.957	0.013	0.686	***0.000***	***0.000***	***0.000***	0.540
		N	***56***	***56***	***54***	53	***64***	64	***64***	63	57	***53***	***57***	60	55	51	61	***64***	64	64	64	64	***64***	***64***	***64***	34
	Project duration (months)	Corr Coeff	***-0.451*****	***-0.264****	-0.237	-0.089	***0.421*****	***0.828*****	1.000	-0.106	0.108	***0.571*****	***0.447*****	0.100	-0.140	-0.016	-0.052	***0.635*****	-0.030	0.080	0.178	0.032	***0.834*****	***0.559*****	***0.942*****	0.009
		Sig. (2-tailed)	***0.000***	***0.050***	0.084	0.526	***0.001***	***0.000***	.	0.410	0.425	***0.000***	***0.000***	0.448	0.309	0.910	0.693	***0.000***	0.812	0.532	0.160	0.799	***0.000***	***0.000***	***0.000***	0.960
		N	***56***	***56***	54	53	***64***	***64***	64	63	57	***53***	***57***	60	55	51	61	***64***	64	64	64	64	***64***	***64***	***64***	34
	Prev_wk	Corr Coeff	0.120	-0.020	0.040	-0.233	-0.174	-0.114	-0.106	1.000	0.172	-0.003	-0.139	0.038	0.123	0.075	0.166	-0.233	0.172	0.244	0.006	-0.235	-0.104	-0.119	-0.050	-0.146
		Sig. (2-tailed)	0.383	0.885	0.774	0.096	0.172	0.374	0.410	.	0.205	0.984	0.308	0.776	0.377	0.604	0.204	0.066	0.177	0.054	0.964	0.064	0.419	0.354	0.697	0.417
		N	55	55	53	52	63	63	63	63	56	52	56	59	54	50	60	63	63	63	63	63	63	63	63	33
	Infl_arch	Corr Coeff	-0.213	-0.151	***0.390*****	-0.240	0.151	0.041	0.108	0.172	1.000	-0.127	0.133	0.083	0.007	-0.125	***0.324****	0.008	-0.164	-0.044	0.026	0.128	0.104	***0.432*****	0.201	-0.293
		Sig. (2-tailed)	0.137	0.302	***0.005***	0.104	0.263	0.759	0.425	0.205	.	0.375	0.344	0.544	0.961	0.402	***0.015***	0.953	0.223	0.747	0.847	0.344	0.442	***0.001***	0.134	0.110
		N	50	49	***50***	47	57	57	57	56	57	51	53	56	51	47	***56***	57	57	57	57	57	57	***57***	57	31
	Infl_ce	Corr Coeff	-0.277	-0.043	***-0.528*****	0.029	***0.306****	***0.622*****	***0.571*****	-0.003	-0.127	1.000	***0.315****	0.108	0.070	0.079	-0.255	***0.430*****	0.162	0.106	***0.286****	-0.023	***0.550*****	0.234	***0.534*****	0.237
		Sig. (2-tailed)	0.065	0.776	***0.000***	0.852	***0.026***	***0.000***	***0.000***	0.984	0.375	.	***0.024***	0.451	0.638	0.608	0.068	***0.001***	0.247	0.448	***0.038***	0.871	***0.000***	0.092	***0.000***	0.233
		N	45	47	***47***	45	***53***	***53***	***53***	52	51	53	***51***	51	48	45	52	***53***	53	53	***53***	53	***53***	53	***53***	27
	Infl_qs	Corr Coeff	***-0.520*****	0.131	-0.230	-0.111	0.187	***0.480*****	***0.447*****	-0.139	0.133	***0.315****	1.000	***0.281****	0.096	***0.331****	-0.030	***0.484*****	0.162	-0.003	0.126	-0.096	***0.475*****	0.126	***0.446*****	0.152
		Sig. (2-tailed)	***0.000***	0.364	0.108	0.451	0.164	***0.000***	***0.000***	0.308	0.344	***0.024***	.	***0.036***	0.497	***0.020***	0.827	***0.000***	0.229	0.982	0.351	0.479	***0.000***	0.352	***0.001***	0.423
		N	***49***	50	50	48	57	***57***	***57***	56	53	***51***	57	***56***	52	***49***	55	***57***	57	57	57	57	***57***	57	***57***	30
	Infl_client	Corr Coeff	0.034	-0.004	-0.198	0.099	-0.011	0.090	0.100	0.038	0.083	0.108	***0.281****	1.000	0.040	0.047	0.097	0.045	0.148	0.023	0.093	-0.181	0.110	0.003	0.162	0.171
		Sig. (2-tailed)	0.811	0.977	0.155	0.493	0.931	0.493	0.448	0.776	0.544	0.451	***0.036***	.	0.772	0.743	0.467	0.734	0.260	0.860	0.479	0.166	0.402	0.982	0.216	0.349
		N	53	52	53	50	60	60	60	59	56	51	***56***	60	55	51	58	60	60	60	60	60	60	60	60	32

		Proj_type1	Proj_type2b	Proj_type3	Proj_type4b	Complexity	Contract price	Project duration	Prev_wk	Infl_arch	Infl_ce	Infl_qs	Infl_client	Infl_mc	Infl_pm	Involve_des	wkrs_on_site	Prior_cost	Prior_time	Prior_qual	Prior_hands	Act_cost	Var	Act_dur	LAD
Infl_mc	Corr Coeff	-0.066	0.018	-0.173	-0.044	-0.176	-0.142	-0.140	0.123	0.007	0.070	0.096	0.040	1.000	0.251	-0.188	-0.158	-0.137	-0.063	-0.001	0.007	-0.183	-0.103	-0.120	0.232
	Sig. (2-tailed)	0.658	0.900	0.228	0.770	0.199	0.303	0.309	0.377	0.961	0.638	0.497	0.772	.	0.089	0.173	0.248	0.320	0.646	0.994	0.960	0.181	0.453	0.382	0.227
	N	48	49	50	47	55	55	55	54	51	48	52	55	55	47	54	55	55	55	55	55	55	55	55	29
Infl_pm	Corr Coeff	-0.122	-0.019	-0.262	-0.168	-0.128	0.079	-0.016	0.075	-0.125	0.079	0.331*	0.047	0.251	1.000	-0.126	0.092	0.297*	0.058	0.050	-0.114	0.035	-0.075	-0.048	0.346
	Sig. (2-tailed)	0.419	0.901	0.082	0.286	0.372	0.583	0.910	0.604	0.402	0.608	0.020	0.743	0.089	.	0.385	0.523	0.034	0.684	0.728	0.425	0.809	0.603	0.737	0.077
	N	46	44	45	42	51	51	51	50	47	45	49	51	47	51	50	51	51	51	51	51	51	51	51	27
Involve_des	Corr Coeff	0.017	0.037	0.051	-0.148	-0.183	-0.236	-0.052	0.166	0.324*	-0.255	-0.030	0.097	-0.188	-0.126	1.000	-0.234	-0.159	0.181	-0.101	-0.006	-0.186	-0.038	-0.019	-0.231
	Sig. (2-tailed)	0.904	0.789	0.716	0.302	0.158	0.067	0.693	0.204	0.015	0.068	0.827	0.467	0.173	0.385	.	0.069	0.221	0.163	0.438	0.963	0.152	0.769	0.886	0.204
	N	54	54	53	51	61	61	61	60	56	52	55	58	54	50	61	61	61	61	61	61	61	61	61	32
wkrs_on_site	Corr Coeff	-0.385**	-0.253	-0.256	0.279*	0.345**	0.798**	0.635**	-0.233	0.008	0.430**	0.484**	0.045	-0.158	0.092	-0.234	1.000	0.039	0.002	0.298*	-0.026	0.797**	0.315*	0.524**	0.327
	Sig. (2-tailed)	0.003	0.060	0.061	0.043	0.005	0.000	0.000	0.066	0.953	0.001	0.000	0.734	0.248	0.523	0.069	.	0.758	0.985	0.017	0.839	0.000	0.011	0.000	0.059
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
Prior_cost	Corr Coeff	0.128	0.125	-0.163	-0.277*	0.134	-0.004	-0.030	0.172	-0.164	0.162	0.162	0.148	-0.137	0.297*	-0.159	0.039	1.000	0.083	-0.047	-0.352**	-0.046	-0.151	-0.024	0.152
	Sig. (2-tailed)	0.347	0.361	0.238	0.045	0.292	0.975	0.812	0.177	0.223	0.247	0.229	0.260	0.320	0.034	0.221	0.758	.	0.515	0.714	0.004	0.717	0.233	0.852	0.389
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
Prior_time	Corr Coeff	-0.139	-0.090	-0.139	-0.034	-0.183	0.007	0.080	0.244	-0.044	0.106	-0.003	0.023	-0.063	0.058	0.181	0.002	0.083	1.000	-0.003	-0.197	-0.012	-0.149	0.068	-0.079
	Sig. (2-tailed)	0.306	0.511	0.318	0.807	0.147	0.957	0.532	0.054	0.747	0.448	0.982	0.860	0.646	0.684	0.163	0.985	0.515	.	0.983	0.118	0.924	0.240	0.595	0.656
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
Prior_qual	Corr Coeff	-0.144	-0.232	-0.072	0.218	0.197	0.309*	0.178	0.006	0.026	0.286*	0.126	0.093	-0.001	0.050	-0.101	0.298*	-0.047	-0.003	1.000	-0.031	0.298*	0.049	0.149	0.115
	Sig. (2-tailed)	0.288	0.085	0.605	0.116	0.119	0.013	0.160	0.964	0.847	0.038	0.351	0.479	0.994	0.728	0.438	0.017	0.714	0.983	.	0.805	0.017	0.700	0.239	0.517
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
Prior_hands	Corr Coeff	-0.136	-0.075	-0.167	-0.050	-0.053	-0.051	0.032	-0.235	0.128	-0.023	-0.096	-0.181	0.007	-0.114	-0.006	-0.026	-0.352**	-0.197	-0.031	1.000	-0.020	0.167	0.025	-0.048
	Sig. (2-tailed)	0.317	0.585	0.228	0.723	0.680	0.686	0.799	0.064	0.344	0.871	0.479	0.166	0.960	0.425	0.963	0.839	0.004	0.118	0.805	.	0.873	0.188	0.848	0.788
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
Act_cost	Corr Coeff	-0.458**	-0.281*	-0.291*	0.153	0.434**	0.973**	0.834**	-0.104	0.104	0.550**	0.475**	0.110	-0.183	0.035	-0.186	0.797**	-0.046	-0.012	0.298*	-0.020	1.000	0.496**	0.796**	0.072
	Sig. (2-tailed)	0.000	0.036	0.033	0.273	0.000	0.000	0.000	0.419	0.442	0.000	0.000	0.402	0.181	0.809	0.152	0.000	0.717	0.924	0.017	0.873	.	0.000	0.000	0.685
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
Var	Corr Coeff	-0.218	-0.175	0.114	-0.059	0.403**	0.506**	0.559**	-0.119	0.432**	0.234	0.126	0.003	-0.103	-0.075	-0.038	0.315*	-0.151	-0.149	0.049	0.167	0.496**	1.000	0.559**	-0.062
	Sig. (2-tailed)	0.106	0.197	0.414	0.673	0.001	0.000	0.000	0.354	0.001	0.092	0.352	0.982	0.453	0.603	0.769	0.011	0.233	0.240	0.700	0.188	0.000	.	0.000	0.726
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
Act_dur	Corr Coeff	-0.495**	-0.289*	-0.185	-0.119	0.473**	0.760**	0.942**	-0.050	0.201	0.534**	0.446**	0.162	-0.120	-0.048	-0.019	0.524**	-0.024	0.068	0.149	0.025	0.796**	0.559**	1.000	0.039
	Sig. (2-tailed)	0.000	0.031	0.180	0.396	0.000	0.000	0.000	0.697	0.134	0.000	0.001	0.216	0.382	0.737	0.886	0.000	0.852	0.595	0.239	0.848	0.000	0.000	.	0.827
	N	56	56	54	53	64	64	64	63	57	53	57	60	55	51	61	64	64	64	64	64	64	64	64	34
LAD (thousand)	Corr Coeff	0.102	-0.011	-0.380*	0.049	0.094	0.109	0.009	-0.146	-0.293	0.237	0.152	0.171	0.232	0.346	-0.231	0.327	0.152	-0.079	0.115	-0.048	0.072	-0.062	0.039	1.000
	Sig. (2-tailed)	0.579	0.953	0.042	0.801	0.597	0.540	0.960	0.417	0.110	0.233	0.423	0.349	0.227	0.077	0.204	0.059	0.389	0.656	0.517	0.788	0.685	0.726	0.827	.
	N	32	32	29	29	34	34	34	33	31	27	30	32	29	27	32	34	34	34	34	34	34	34	34	34

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Appendix H Indexes (dimensions) of culture constructed from questionnaire items

		Questionnaire items		
		Attitudes & perceptions	Behaviour	Situational context
Leadership				
L1	Access and approachability	CAL1	CBL1	CSL1
L2	Supportiveness & appreciation	CAL2	CBL2	CSL2
L3	Control of workers' behaviour	CAL3	CBL3	CSL3
L4	Participation	CAL4	CBL4	CSL4
L5	Keeping operatives informed	CAL5	CBL5	CSL5
L6	Communication	CAL6	CBL6	CSL6
Commitment to client				
C1	Contact & communication	CAC1	CBC1	CSC1
C2	Research into end-user needs	CAC2	CBC2	CSC2
C3	Educating client	CAC3	CBC3	CSC3
C4	Monitoring satisfaction	CAC4	CBC4	CSC4
C5	Precedence of client's needs	CAC5	CBC5	CSC5
C6	Respect for client	CAC6	CBC6	CSC6
Team ethos				
T1	Collaborative working	CAT1	CBT1	CST1
T2	Trust	CAT2	CBT2	CST2
T3	Emphasis on teamwork	CAT3	CBT3	CST3
T4	Dealing with conflict by compromise	CAT4	CBT4	CST4
T5	Information sharing	CAT5	CBT5	CST5
T6	Identification with project	CAT6	CBT6	CST6
T7	Free & open communication	CAT7	CBT7	CST7
T8	Blame culture	CAT8	CBT8	CST8
Project delivery				
P1	Innovation	CAP1	CBP1	CSP1
P2	Learning on project	CAP2	CBP2	CSP2
P3	Monitoring performance	CAP3	CBP3	CSP3
P4	Providing performance feedback	CAP4	CBP4	CSP4
P5	Waste elimination	CAP5	CBP5	CSP5
P6	On-time delivery	CAP6	CBP6	CSP6
P7	Driving down cost	CAP7	CBP7	CSP7
P8	Quality & getting it right first time	CAP8	CBP8	CSP8
P9	Environmental friendliness	CAP9	CBP9	CSP9
Commitment to workforce				
W1	Subcontracting	CAW1	CBW1	CSW1
W2	Showing concern for workers	CAW2	CBW2	CSW2
W3	Respect for all workers	CAW3	CBW3	CSW3
W4	Motivating workforce	CAW4	CBW4	CSW4
W5	Training	CAW5	CBW5	CSW5
W6	Safeguarding health & safety	CAW6	CBW6	CSW6
W7	Site tidiness	CAW7	CBW7	CSW7
W8	Recognising good performance	CAW8	CBW8	CSW8

Appendix I Factor Analysis of cultural variables

Table 1 Communalities

	Initial	Extraction
L1	1.000	.626
L2	1.000	.643
L3	1.000	.780
L4	1.000	.724
L5	1.000	.757
L6	1.000	.737
C1	1.000	.710
C2	1.000	.697
C3	1.000	.815
C4	1.000	.779
C5	1.000	.752
C6	1.000	.820
T1	1.000	.687
T2	1.000	.700
T3	1.000	.810
T4	1.000	.747
T5	1.000	.628
T6	1.000	.655
T7	1.000	.806
T8	1.000	.776
P1	1.000	.609
P2	1.000	.622
P3	1.000	.685
P4	1.000	.749
P5	1.000	.695
P6	1.000	.799
P7	1.000	.728
P8	1.000	.751
P9	1.000	.679
W1	1.000	.792
W2	1.000	.803
W3	1.000	.735
W4	1.000	.780
W5	1.000	.809
W6	1.000	.881
W7	1.000	.844
W8	1.000	.723

Extraction Method: Principal Component Analysis.

Table 2 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.506	39.206	39.206	14.506	39.206	39.206	9.025	24.391	24.391
2	3.593	9.712	48.918	3.593	9.712	48.918	3.447	9.315	33.707
3	2.153	5.818	54.736	2.153	5.818	54.736	3.298	8.914	42.621
4	1.756	4.745	59.481	1.756	4.745	59.481	3.106	8.395	51.017
5	1.621	4.382	63.863	1.621	4.382	63.863	2.963	8.009	59.026
6	1.443	3.901	67.763	1.443	3.901	67.763	1.983	5.359	64.385
7	1.182	3.195	70.959	1.182	3.195	70.959	1.934	5.228	69.613
8	1.080	2.919	73.878	1.080	2.919	73.878	1.578	4.265	73.878
9	.909	2.457	76.335						
10	.850	2.297	78.632						
11	.761	2.056	80.688						
12	.675	1.825	82.513						
13	.620	1.677	84.190						
14	.603	1.629	85.818						
15	.571	1.544	87.362						
16	.500	1.350	88.712						
17	.436	1.178	89.890						
18	.404	1.092	90.982						
19	.387	1.047	92.028						
20	.369	.998	93.026						
21	.333	.900	93.926						
22	.310	.839	94.765						
23	.260	.703	95.468						
24	.238	.642	96.110						
25	.223	.601	96.712						
26	.205	.553	97.264						
27	.177	.479	97.743						
28	.168	.455	98.198						
29	.139	.375	98.573						
30	.118	.319	98.892						
31	.093	.250	99.142						
32	.078	.212	99.354						
33	.067	.181	99.535						
34	.062	.166	99.702						
35	.050	.134	99.835						
36	.034	.092	99.928						
37	.027	.072	100.000						

Extraction Method: Principal Component Analysis.

Table 3 Component Score Coefficient Matrix

	Component				
	1	2	3	4	5
L1	-.020	.039	.201	-.008	-.063
L2	.070	-.049	-.071	.047	.064
L3	.064	.015	-.128	-.049	.130
L4	.112	-.085	.014	-.098	.161
L5	.071	-.010	.020	-.011	.039
L6	.095	-.006	.072	-.067	-.070
C1	-.102	.003	.019	.236	.119
C2	.058	-.045	-.011	.123	-.101
C3	.003	-.085	-.012	.310	-.145
C4	-.046	.046	-.087	.261	-.061
C5	-.095	-.002	.092	.257	.037
C6	.023	.003	.100	.120	-.154
T1	.167	-.233	.115	-.027	-.054
T2	.031	-.078	.128	-.001	.119
T3	.117	-.044	.018	-.073	.004
T4	.094	.028	-.090	-.033	-.097
T5	-.017	.056	.136	-.051	.110
T6	-.022	.029	.019	-.102	.384
T7	.075	.041	.025	-.054	-.028
T8	.001	.089	-.233	-.019	-.026
P1	.067	-.119	-.156	.120	.069
P2	.036	.078	-.074	-.036	.077
P3	-.045	.130	-.091	.072	.083
P4	-.084	.213	-.064	.031	.132
P5	-.070	.095	.055	-.054	.265
P6	-.070	.218	-.002	-.003	-.019
P7	-.019	.112	-.123	.014	.029
P8	-.050	.160	.052	.001	.012
P9	.054	-.056	-.047	.069	.104
W1	.006	.201	.101	-.207	-.324
W2	.025	.042	.069	.073	-.118
W3	.064	-.010	.049	.026	-.069
W4	.147	-.148	.052	.017	-.107
W5	.040	.120	-.014	-.063	-.016
W6	-.046	.282	.031	-.109	-.067
W7	.092	.077	-.006	-.151	-.015
W8	.106	.004	-.047	-.083	-.009

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table 4 Tests of Normality

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
workforce orientation	.112	64	.046	.911	64	.000
performance orientation	.091	64	.200*	.974	64	.191
team orientation	.092	64	.200*	.916	64	.000
client orientation	.152	64	.001	.933	64	.002
project orientation	.112	64	.043	.919	64	.000

* This is a lower bound of the true significance.
a Lilliefors Significance Correction

Appendix J Cluster analysis output for dimensions of culture

Table 1 Case Processing Summary(a,b)

Cases					
Valid		Missing		Total	
N	Percent	N	Percent	N	Percent
64	100.0	0	.0	64	100.0

a Squared Euclidean Distance used
b Complete Linkage

Table 2 Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	9	49	.284	0	0	21
2	18	19	.293	0	0	22
3	31	54	.339	0	0	10
4	21	51	.499	0	0	25
5	8	55	.634	0	0	21
6	14	36	.659	0	0	41
7	3	4	.700	0	0	10
8	2	24	.723	0	0	38
9	37	60	.770	0	0	30
10	3	31	.838	7	3	36
11	22	46	.845	0	0	30
12	23	41	.859	0	0	46
13	11	52	.961	0	0	35
14	48	62	.983	0	0	29
15	32	58	.990	0	0	33
16	16	33	1.000	0	0	39
17	39	64	1.041	0	0	44
18	1	13	1.055	0	0	39
19	27	50	1.076	0	0	22
20	7	17	1.164	0	0	32
21	8	9	1.213	5	1	34
22	18	27	1.392	2	19	38
23	15	40	1.550	0	0	42
24	47	57	1.585	0	0	47
25	12	21	1.615	0	4	36
26	20	28	1.631	0	0	46
27	42	59	1.831	0	0	34
28	26	29	1.834	0	0	42
29	6	48	1.927	0	14	41
30	22	37	2.248	11	9	44
31	25	61	2.263	0	0	56
32	7	34	2.338	20	0	52
33	30	32	2.357	0	15	45
34	8	42	2.445	21	27	49
35	5	11	2.465	0	13	50
36	3	12	2.504	10	25	48
37	10	53	2.551	0	0	43
38	2	18	2.565	8	22	49
39	1	16	2.795	18	16	55
40	43	63	2.930	0	0	52
41	6	14	3.920	29	6	47
42	15	26	3.935	23	28	54

43	10	45	4.093	37	0	50
44	22	39	4.310	30	17	48
45	30	44	4.488	33	0	53
46	20	23	4.815	26	12	53
47	6	47	5.074	41	24	54
48	3	22	6.013	36	44	51
49	2	8	6.325	38	34	51
50	5	10	6.423	35	43	57
51	2	3	8.808	49	48	56
52	7	43	9.166	32	40	61
53	20	30	9.798	46	45	55
54	6	15	10.945	47	42	59
55	1	20	11.114	39	53	59
56	2	25	16.123	51	31	57
57	2	5	22.755	56	50	60
58	35	56	26.639	0	0	63
59	1	6	26.828	55	54	60
60	1	2	33.265	59	57	61
61	1	7	36.356	60	52	62
62	1	38	54.700	61	0	63
63	1	35	58.714	62	58	0

Table 3 Mean ranks for different typologies

	cluster	N	Mean Rank
workforce orientation	A	2	1.50
	B	1	64.00
	C	5	51.00
	D	23	26.52
	E	33	34.79
	Total	64	
performance orientation	A	2	27.50
	B	1	8.00
	C	5	27.60
	D	23	34.74
	E	33	32.73
	Total	64	
team orientation	A	2	29.50
	B	1	1.00
	C	5	61.20
	D	23	42.09
	E	33	22.61
	Total	64	
client orientation	A	2	7.50
	B	1	18.00
	C	5	7.20
	D	23	42.91
	E	33	31.03
	Total	64	
project orientation	A	2	43.50
	B	1	49.00
	C	5	23.40
	D	23	22.74
	E	33	39.52
	Total	64	

Appendix K Kruskal-Wallis and Mann-Whitney ANOVA, and Bivariate correlation results for culture and contextual factors

Table 1 Mann-Whitney Test Statistics

	Statistics	workforce orientation	performance orientation	team orientation	client orientation	project orientation
Proj_type1	Mann-Whitney U	369.000	294.000	322.000	331.000	380.000
	Wilcoxon W	669.000	822.000	622.000	859.000	680.000
	Z	-0.248	-1.490	-1.027	-0.878	-0.066
	Asymp. Sig. (2-tailed)	0.804	0.136	0.305	0.380	0.947
Proj_type2b	Mann-Whitney U	357.000	370.000	342.000	371.000	352.000
	Wilcoxon W	952.000	623.000	937.000	624.000	947.000
	Z	-0.285	-0.067	-0.537	-0.050	-0.369
	Asymp. Sig. (2-tailed)	0.775	0.946	0.591	0.960	0.712
Proj_type3	Mann-Whitney U	202.000	175.000	219.000	144.000	209.000
	Wilcoxon W	1,192.000	1,165.000	274.000	1,134.000	1,199.000
	Z	-0.401	-1.002	-0.022	-1.692	-0.245
	Asymp. Sig. (2-tailed)	0.689	0.316	0.982	0.091	0.806
Proj_type4b	Mann-Whitney U	215.000	237.000	214.000	208.000	175.000
	Wilcoxon W	1,035.000	1,057.000	1,034.000	299.000	266.000
	Z	-0.930	-0.475	-0.951	-1.075	-1.757
	Asymp. Sig. (2-tailed)	0.352	0.634	0.342	0.282	0.079
Prev_wk	Mann-Whitney U	426.000	392.000	308.000	347.000	327.000
	Wilcoxon W	1,329.000	623.000	1,211.000	578.000	558.000
	Z	-0.219	-0.714	-1.939	-1.371	-1.662
	Asymp. Sig. (2-tailed)	0.827	0.475	0.052	0.171	0.096
Involve_des	Mann-Whitney U	360.000	440.000	452.000	401.000	401.000
	Wilcoxon W	738.000	1,035.000	830.000	996.000	779.000
	Z	-1.438	-0.276	-0.102	-0.842	-0.842
	Asymp. Sig. (2-tailed)	0.151	0.783	0.919	0.400	0.400

Table 2 Kruskal-Wallis ANOVA results

	Statistic	workforce orientation	performance orientation	team orientation	client orientation	project orientation
Proj_type2	Chi-Square	2.109	0.509	2.093	1.230	4.311
	df	3	3	3	3	3
	Asymp. Sig.	0.550	0.917	0.553	0.746	0.230
Proj_type4	Chi-Square	7.353	3.396	7.895	4.485	12.434
	df	7	7	7	7	7
	Asymp. Sig.	0.393	0.846	0.342	0.722	0.087
Proj_loc	Chi-Square	6.782	8.560	11.459	14.007	***20.000***
	df	11	11	11	11	***11***
	Asymp. Sig.	0.816	0.662	0.406	0.233	***0.045***
Proc_route	Chi-Square	10.310	6.068	10.836	10.456	9.667
	df	8	8	8	8	8
	Asymp. Sig.	0.244	0.640	0.211	0.234	0.289
Most_infl	Chi-Square	3.599	3.965	4.288	3.712	2.240
	df	4	4	4	4	4
	Asymp. Sig.	0.463	0.411	0.368	0.446	0.692
Top_prior	Chi-Square	1.783	5.655	4.633	2.353	0.179
	df	3	3	3	3	3
	Asymp. Sig.	0.619	0.130	0.201	0.502	0.981

Table 3 Nonparametric Correlations between Project characteristics and cultural orientation

			workforce orientation	performance orientation	team orientation	client orientation	project orientation
Spearman's rho	Complexity	Correlation Coefficient	-0.075	0.204	***-0.281****	***0.299****	0.134
		Sig. (2-tailed)	0.553	0.105	***0.025***	***0.017***	0.290
		N	64	64	***64***	***64***	64
	Contract price (million)	Correlation Coefficient	-0.117	***0.288****	-0.176	0.173	-0.058
		Sig. (2-tailed)	0.357	***0.021***	0.165	0.173	0.648
		N	64	***64***	64	64	64
	Project duration (months)	Correlation Coefficient	-0.066	0.224	-0.201	0.133	-0.104
		Sig. (2-tailed)	0.606	0.076	0.111	0.295	0.412
		N	64	64	64	64	64
	Infl_arch	Correlation Coefficient	-0.022	0.104	-0.182	-0.141	-0.107
		Sig. (2-tailed)	0.873	0.442	0.176	0.295	0.430
		N	57	57	57	57	57
	Infl_ce	Correlation Coefficient	0.191	0.155	-0.149	0.038	-0.012
		Sig. (2-tailed)	0.170	0.269	0.287	0.786	0.932
		N	53	53	53	53	53
	Infl_qs	Correlation Coefficient	-0.094	***0.336****	-0.193	-0.036	-0.036
		Sig. (2-tailed)	0.487	***0.011***	0.151	0.791	0.789
		N	57	***57***	57	57	57
	Infl_client	Correlation Coefficient	***0.381*****	0.192	0.179	0.052	-0.048
		Sig. (2-tailed)	***0.003***	0.141	0.170	0.693	0.715
		N	***60***	60	60	60	60
	Infl_mc	Correlation Coefficient	0.149	-0.116	0.100	0.012	***-0.293****
		Sig. (2-tailed)	0.278	0.397	0.466	0.928	***0.030***
		N	55	55	55	55	***55***
	Infl_pm	Correlation Coefficient	0.151	0.158	0.034	-0.107	-0.105
		Sig. (2-tailed)	0.290	0.269	0.813	0.453	0.466
		N	51	51	51	51	51
	wkrs_on_site	Correlation Coefficient	-0.072	***0.255****	-0.202	0.165	0.017
		Sig. (2-tailed)	0.571	***0.042***	0.109	0.192	0.893
		N	64	***64***	64	64	64
	Prior_cost	Correlation Coefficient	***0.266****	0.176	0.233	0.005	0.166
		Sig. (2-tailed)	***0.034***	0.164	0.064	0.971	0.190
		N	***64***	64	64	64	64
	Prior_time	Correlation Coefficient	0.206	0.005	0.191	-0.013	-0.106
		Sig. (2-tailed)	0.102	0.969	0.131	0.921	0.406
		N	64	64	64	64	64
	Prior_qual	Correlation Coefficient	0.004	-0.093	0.031	0.162	-0.058
		Sig. (2-tailed)	0.974	0.463	0.806	0.200	0.648
		N	64	64	64	64	64
	Prior_hands	Correlation Coefficient	-0.105	***-0.295****	***-0.299****	0.002	-0.001
		Sig. (2-tailed)	0.410	***0.018***	***0.016***	0.985	0.996
		N	64	***64***	***64***	64	64
	Var	Correlation Coefficient	-0.134	0.053	***-0.259****	0.146	-0.124
		Sig. (2-tailed)	0.292	0.680	***0.039***	0.249	0.330
		N	64	64	***64***	64	64

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Appendix L Correlation matrix of the performance measures

			Cost Perf (%)	Cost Perf (%) (Banded)	CP4	Sat_cost	Time Perf (%)	Time Perf (%) (Banded)	TP4	Sat_time	Defects	Sat_qual	Sat_serv	Rep_wk	Acc_rep	Near_misses	Injuries	Prod	Absent	Disp_client	Disp_others	Claims	Learn	Innov	Sat_fac	Sat_wages	Sat_prof	Sat_harm
Spearman's rho	Cost Perf (%)	Corr. Coeff.	1.000																									
		Sig. (2-tailed)	.																									
	Cost Perf (%) (Banded)	Corr. Coeff.	0.993**	1.000																								
		Sig. (2-tailed)	0.000	.																								
	CP4	Corr. Coeff.	0.894**	0.894**	1.000																							
		Sig. (2-tailed)	0.000	0.000	.																							
	Sat_cost	Corr. Coeff.	-0.122	-0.136	-0.113	1.000																						
		Sig. (2-tailed)	0.338	0.283	0.375	.																						
	Time Perf (%)	Corr. Coeff.	0.281*	0.280*	0.225	-0.227	1.000																					
		Sig. (2-tailed)	0.024	0.025	0.074	0.071	.																					
	Time Perf (%) (Banded)	Corr. Coeff.	0.266*	0.266*	0.228	-0.214	0.981**	1.000																				
		Sig. (2-tailed)	0.033	0.033	0.070	0.089	0.000	.																				
	TP4	Corr. Coeff.	0.245	0.244	0.213	-0.238	0.960**	0.938**	1.000																			
		Sig. (2-tailed)	0.051	0.052	0.091	0.058	0.000	0.000	.																			
	Sat_time	Corr. Coeff.	-0.160	-0.165	-0.092	0.623**	-0.420**	-0.436**	-0.412**	1.000																		
		Sig. (2-tailed)	0.208	0.192	0.472	0.000	0.001	0.000	0.001	.																		
	Defects	Corr. Coeff.	0.200	0.187	0.185	-0.111	0.150	0.164	0.188	-0.313*	1.000																	
		Sig. (2-tailed)	0.116	0.141	0.147	0.385	0.242	0.200	0.140	0.013	.																	
	Sat_qual	Corr. Coeff.	0.163	0.140	0.007	0.381**	0.166	0.163	0.175	0.293*	0.031	1.000																
		Sig. (2-tailed)	0.198	0.269	0.958	0.002	0.191	0.198	0.167	0.019	0.807	.																
	Sat_serv	Corr. Coeff.	0.119	0.093	0.032	0.454**	-0.006	0.004	0.021	0.475**	-0.057	0.679**	1.000															
		Sig. (2-tailed)	0.351	0.463	0.803	0.000	0.965	0.975	0.871	0.000	0.655	0.000	.															
	Rep_wk	Corr. Coeff.	-0.152	-0.150	-0.200	0.017	0.068	0.076	0.073	-0.038	0.063	-0.174	-0.107	1.000														
		Sig. (2-tailed)	0.233	0.241	0.116	0.894	0.594	0.554	0.568	0.769	0.623	0.173	0.404	.														
	Acc_rep	Corr. Coeff.	-0.003	-0.006	-0.026	-0.183	0.067	0.064	0.104	-0.175	0.291*	-0.024	-0.009	-0.241	1.000													
		Sig. (2-tailed)	0.984	0.962	0.841	0.149	0.596	0.615	0.412	0.167	0.021	0.850	0.941	0.057	.													
	Near_misses	Corr. Coeff.	0.023	0.024	0.045	0.045	-0.134	-0.113	-0.101	-0.193	0.150	-0.056	-0.212	-0.108	0.430**	1.000												
		Sig. (2-tailed)	0.855	0.848	0.722	0.722	0.292	0.374	0.429	0.127	0.241	0.661	0.093	0.400	0.000	.												
	Injuries	Corr. Coeff.	0.041	0.049	0.094	0.002	0.020	0.021	0.066	-0.093	0.195	0.004	-0.054	-0.128	0.638**	0.613**	1.000											
		Sig. (2-tailed)	0.746	0.700	0.460	0.990	0.876	0.868	0.604	0.463	0.126	0.978	0.672	0.319	0.000	0.000	.											
	Prod	Corr. Coeff.	0.058	0.043	0.036	0.132	-0.089	-0.137	-0.146	0.255*	-0.184	0.038	0.212	-0.240	-0.016	-0.179	-0.067	1.000										
		Sig. (2-tailed)	0.651	0.738	0.781	0.298	0.487	0.281	0.251	0.042	0.150	0.767	0.092	0.058	0.902	0.157	0.596	.										
	Absent	Corr. Coeff.	0.084	0.102	0.194	-0.178	0.077	0.087	0.126	-0.237	0.302*	-0.185	-0.256	-0.036	0.347**	0.348**	0.366**	-0.278*	1.000									
		Sig. (2-tailed)	0.537	0.452	0.147	0.184	0.568	0.519	0.349	0.076	0.023	0.167	0.054	0.790	0.008	0.008	0.005	0.036	.									
	Disp_client	Corr. Coeff.	-0.055	-0.066	0.008	-0.168	0.125	0.136	0.089	-0.198	0.229	-0.186	-0.219	0.359**	-0.067	0.075	0.017	-0.140	0.141	1.000								
		Sig. (2-tailed)	0.666	0.602	0.949	0.186	0.324	0.283	0.483	0.116	0.071	0.140	0.082	0.004	0.599	0.556	0.892	0.270	0.295	.								
	Disp_others	Corr. Coeff.	0.123	0.109	0.140	-0.386**	0.310*	0.295*	0.367**	-0.506**	0.163	-0.216	-0.270*	0.154	0.146	0.256*	0.118	-0.235	0.141	0.442**	1.000							
		Sig. (2-tailed)	0.334	0.391	0.269	0.002	0.013	0.018	0.003	0.000	0.202	0.087	0.031	0.228	0.250	0.041	0.354	0.062	0.296	0.000	.							
	Claims	Corr. Coeff.	0.218	0.217	0.169	-0.227	0.325**	0.295*	0.272*	-0.303*	0.141	-0.108	-0.359**	0.233	-0.017	0.233	0.152	-0.245	0.120	0.293*	0.348**	1.000						
		Sig. (2-tailed)	0.083	0.086	0.183	0.071	0.009	0.018	0.030	0.015	0.271	0.395	0.004	0.066	0.896	0.064	0.231	0.051	0.372	0.019	0.005	.						
	Learn	Corr. Coeff.	-0.103	-0.093	-0.081	-0.092	-0.066	-0.040	-0.015	0.006	0.165	-0.125	0.028	-0.081	0.385**	0.205	0.327**	0.236	0.213	0.031	0.079	-0.038	1.000					
		Sig. (2-tailed)	0.418	0.464	0.523	0.471	0.606	0.755	0.908	0.966	0.197	0.325	0.824	0.527	0.002	0.104	0.008	0.060	0.112	0.806	0.537	0.769	.					

		Cost Perf (%)	Cost Perf (%) (Banded)	CP4	Sat_cost	Time Perf (%)	Time Perf (%) (Banded)	TP4	Sat_time	Defects	Sat_qual	Sat_serv	Rep_wk	Acc_rep	Near_misses	Injuries	Prod	Absent	Disp_client	Disp_others	Claims	Learn	Innov	Sat_fac	Sat_wages	Sat_prof	Sat_harm
Innov	Corr. Coeff.	-0.156	-0.165	-0.096	-0.026	-0.051	-0.066	-0.026	0.073	0.096	-0.189	-0.008	***-0.263****	***0.260****	0.131	0.077	0.145	0.220	-0.054	-0.050	0.140	***0.408*****	1.000				
	Sig. (2-tailed)	0.217	0.194	0.452	0.837	0.690	0.607	0.837	0.566	0.454	0.135	0.952	***0.037***	***0.038***	0.301	0.546	0.253	0.099	0.672	0.694	0.270	***0.001***	.				
Sat_fac	Corr. Coeff.	0.064	0.043	0.022	0.230	-0.001	0.008	0.024	***0.376*****	-0.128	***0.344*****	***0.512*****	0.038	-0.149	-0.028	-0.032	***0.287****	***-0.358*****	-0.112	-0.129	***-0.332*****	0.082	-0.138	1.000			
	Sig. (2-tailed)	0.613	0.736	0.863	0.067	0.991	0.947	0.853	***0.002***	0.316	***0.005***	***0.000***	0.766	0.239	0.825	0.802	***0.022***	***0.006***	0.380	0.311	***0.007***	0.522	0.278	.			
Sat_wages	Corr. Coeff.	0.130	0.126	0.102	0.197	-0.046	-0.037	-0.038	***0.291*****	-0.081	0.202	***0.261*****	-0.035	-0.162	-0.142	-0.131	***0.315****	***-0.363*****	-0.175	***-0.286****	-0.244	-0.057	-0.104	***0.582*****	1.000		
	Sig. (2-tailed)	0.306	0.321	0.424	0.118	0.718	0.770	0.768	***0.020***	0.527	0.109	***0.037***	0.787	0.201	0.262	0.301	***0.011***	***0.006***	0.167	***0.022***	0.052	0.655	0.412	***0.000***	.		
Sat_prof	Corr. Coeff.	0.056	0.057	0.087	***0.413*****	-0.013	0.017	0.029	***0.290****	-0.054	***0.447*****	***0.433*****	-0.219	-0.028	-0.111	-0.011	-0.023	-0.239	***-0.253****	-0.142	-0.226	-0.113	-0.030	0.173	0.233	1.000	
	Sig. (2-tailed)	0.662	0.657	0.492	***0.001***	0.917	0.893	0.818	***0.020***	0.675	***0.000***	***0.000***	0.085	0.825	0.384	0.930	0.859	0.074	***0.044***	0.262	0.072	0.372	0.814	0.173	0.064	.	
Sat_harm	Corr. Coeff.	0.027	0.017	0.018	***0.372*****	0.085	0.113	0.107	***0.323*****	-0.008	***0.429*****	***0.593*****	-0.237	0.090	-0.091	0.106	0.210	-0.131	***-0.282****	-0.179	***-0.271****	0.235	0.140	***0.293****	0.074	***0.546*****	1.000
	Sig. (2-tailed)	0.830	0.892	0.888	***0.002***	0.504	0.374	0.402	***0.009***	0.948	***0.000***	***0.000***	0.061	0.478	0.473	0.404	0.096	0.331	***0.024***	0.156	***0.030***	0.061	0.271	***0.019***	0.562	***0.000***	.

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Appendix M Factor analysis of performance measures

Table 1 Communalities

	Initial	Extraction
Defects	1.000	.472
Acc_rep	1.000	.615
Near_misses	1.000	.564
Injuries	1.000	.643
Prod	1.000	.565
Absent	1.000	.570
Disp_client	1.000	.735
Disp_others	1.000	.612
Claims	1.000	.643
Learn	1.000	.678
Innov	1.000	.738
Sat_serv	1.000	.758
Sat_cost	1.000	.622
Sat_time	1.000	.655
Sat_qual	1.000	.763
Sat_fac	1.000	.825
Sat_wages	1.000	.771
Sat_prof	1.000	.653
Sat_harm	1.000	.729
Cost Performance (%)	1.000	.443
Time Performance (%)	1.000	.750

Extraction Method: Principal Component Analysis.

Table 2 Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.110	24.332	24.332	5.110	24.332	24.332	3.676	17.504	17.504
2	2.705	12.879	37.211	2.705	12.879	37.211	2.618	12.468	29.972
3	1.778	8.466	45.677	1.778	8.466	45.677	2.302	10.961	40.933
4	1.669	7.946	53.623	1.669	7.946	53.623	2.011	9.576	50.508
5	1.303	6.204	59.827	1.303	6.204	59.827	1.824	8.685	59.194
6	1.239	5.898	65.726	1.239	5.898	65.726	1.372	6.532	65.726
7	.994	4.735	70.461						
8	.849	4.044	74.505						
9	.809	3.850	78.355						
10	.720	3.427	81.782						
11	.627	2.988	84.770						
12	.578	2.753	87.523						
13	.490	2.335	89.858						
14	.439	2.090	91.948						
15	.396	1.886	93.834						
16	.364	1.734	95.568						
17	.250	1.191	96.759						
18	.228	1.088	97.847						
19	.188	.893	98.740						
20	.168	.802	99.542						
21	.096	.458	100.000						

Extraction Method: Principal Component Analysis.

Table 3 Component Score Coefficient Matrix

	Component			
	1	2	3	4
Defects	.083	.211	-.078	.057
Acc_rep	.047	.244	.008	.042
Near_misses	.025	.211	.021	.012
Injuries	.122	.261	-.015	.020
Prod	.002	-.095	.308	.109
Absent	-.032	.176	.033	-.124
Disp_client	.008	.035	-.176	-.026
Disp_others	-.028	.116	-.189	.036
Claims	-.083	.006	.036	.321
Learn	-.041	.096	.347	-.046
Innov	-.086	.066	.400	-.035
Sat_serv	.227	.078	.016	.089
Sat_cost	.164	.015	-.069	-.153
Sat_time	.094	-.082	.100	-.095
Sat_qual	.273	.132	-.179	.169
Sat_fac	.110	-.062	.076	.075
Sat_wages	.059	-.120	.103	.113
Sat_prof	.172	.015	-.122	-.108
Sat_harm	.195	.125	.069	-.003
Cost Performance (%)	.015	-.009	.012	.286
Time Performance (%)	.065	.014	.015	.479

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Component Scores.

Table 4 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
satisfaction of participants	.086	57	.200*	.977	57	.359
h&s and quality outcomes	.152	57	.002	.906	57	.000
innovation and learning	.086	57	.200*	.970	57	.175
time and cost outcomes	.207	57	.000	.748	57	.000
overall performance	.126	57	.024	.943	57	.010

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Appendix N Kruskal-Wallis and Mann-Whitney ANOVA, and Bivariate correlation results for performance and contextual factors

Table 1 Mann-Whitney Test Statistics

	Statistics	satisfaction of participants	h&s and quality outcomes	innovation and learning	time and cost outcomes	overall performance
Proj_type1	Mann-Whitney U	248.000	222.000	214.000	296.000	270.000
	Wilcoxon W	458.000	687.000	679.000	506.000	480.000
	Z	-1.030	-1.545	-1.703	-.079	-.594
	Asymp. Sig. (2-tailed)	.303	.122	.089	.937	.552
Proj_type2b	Mann-Whitney U	256.000	***176.000***	237.000	***178.000***	254.000
	Wilcoxon W	409.000	***329.000***	390.000	***706.000***	407.000
	Z	-.336	***-2.016***	-.735	***-1.974***	-.378
	Asymp. Sig. (2-tailed)	.737	***.044***	.462	***.048***	.705
Proj_type3	Mann-Whitney U	138.000	140.000	108.000	119.000	90.000
	Wilcoxon W	958.000	960.000	928.000	147.000	910.000
	Z	-.060	.000	-.956	-.627	-1.494
	Asymp. Sig. (2-tailed)	.952	1.000	.339	.530	.135
Proj_type4b	Mann-Whitney U	160.000	138.000	***111.000***	181.000	178.000
	Wilcoxon W	790.000	204.000	***177.000***	811.000	244.000
	Z	-.837	-1.403	***-2.099***	-.296	-.373
	Asymp. Sig. (2-tailed)	.403	.160	***.036***	.767	.709
Prev_wk	Mann-Whitney U	276.000	332.000	294.000	314.000	301.000
	Wilcoxon W	979.000	1035.000	484.000	1017.000	491.000
	Z	-1.307	-.337	-.995	-.649	-.874
	Asymp. Sig. (2-tailed)	.191	.736	.320	.516	.382
Involve_des	Mann-Whitney U	361.000	343.000	254.000	354.000	278.000
	Wilcoxon W	796.000	668.000	579.000	679.000	603.000
	Z	-.026	-.338	-1.882	-.147	-1.466
	Asymp. Sig. (2-tailed)	.979	.735	.060	.883	.143

Table 2 Kruskal-Wallis ANOVA results

	Statistics	satisfaction of participants	h&s and quality outcomes	innovation and learning	time and cost outcomes	overall performance
Proj_type2	Chi-Square	1.817	***8.351***	.800	6.853	2.994
	df	3	***3***	3	3	3
	Asymp. Sig.	.611	***.039***	.849	.077	.393
Proj_type4	Chi-Square	7.811	10.034	7.838	8.003	10.103
	df	7	7	7	7	7
	Asymp. Sig.	.350	.187	.347	.332	.183
Proj_loc	Chi-Square	16.747	18.803	7.632	10.339	14.659
	df	11	11	11	11	11
	Asymp. Sig.	.116	.065	.746	.500	.199
Proc_route	Chi-Square	4.848	4.708	7.714	4.764	9.639
	df	6	6	6	6	6
	Asymp. Sig.	.563	.582	.260	.574	.141
Most_infl	Chi-Square	7.696	3.431	4.206	2.890	4.478
	df	4	4	4	4	4
	Asymp. Sig.	.103	.488	.379	.576	.345
Top_prior	Chi-Square	5.648	5.179	3.338	2.134	2.433
	df	3	3	3	3	3
	Asymp. Sig.	.130	.159	.342	.545	.488

Table 3 Non-parametric correlations between contextual factors and performance outcomes

			satisfaction of participants	h&s and quality outcomes	innovation and learning	time and cost outcomes	overall performance
Spearman's rho	Proj_type1	Correlation Coefficient	.147	-.221	-.243	.011	.085
		Sig. (2-tailed)	.308	.124	.089	.938	.558
		N	50	50	50	50	50
	Proj_type2b	Correlation Coefficient	-.049	-.291*	-.106	.285*	-.055
		Sig. (2-tailed)	.741	.042	.468	.047	.710
		N	49	49	49	49	49
	Proj_type3	Correlation Coefficient	-.009	.000	-.141	.093	-.220
		Sig. (2-tailed)	.953	1.000	.345	.536	.137
		N	47	47	47	47	47
	Proj_type4b	Correlation Coefficient	-.125	.209	.313*	-.044	.056
		Sig. (2-tailed)	.409	.163	.034	.771	.713
		N	46	46	46	46	46
	Complexity	Correlation Coefficient	.019	.310*	.457**	.081	.009
		Sig. (2-tailed)	.890	.019	.000	.548	.948
		N	57	57	57	57	57
	Contract price (million)	Correlation Coefficient	-.208	.617**	.203	-.175	-.125
		Sig. (2-tailed)	.120	.000	.129	.192	.354
		N	57	57	57	57	57
	Project duration (months)	Correlation Coefficient	-.177	.605**	.221	-.088	-.170
		Sig. (2-tailed)	.187	.000	.098	.516	.206
		N	57	57	57	57	57
	Infl_arch	Correlation Coefficient	.176	.046	-.134	.088	-.118
		Sig. (2-tailed)	.194	.739	.324	.521	.387
		N	56	56	56	56	56
	Infl_ce	Correlation Coefficient	.053	.170	.123	.051	-.160
		Sig. (2-tailed)	.713	.234	.390	.720	.263
		N	51	51	51	51	51
	Infl_qs	Correlation Coefficient	.005	.388**	.281	-.011	.055
		Sig. (2-tailed)	.976	.006	.053	.940	.709
		N	48	48	48	48	48
	Infl_client	Correlation Coefficient	-.213	.281*	.057	.045	-.159
		Sig. (2-tailed)	.133	.046	.692	.752	.265
		N	51	51	51	51	51
	Infl_mc	Correlation Coefficient	.251	.083	.101	.146	.049
		Sig. (2-tailed)	.070	.555	.473	.296	.728
		N	53	53	53	53	53
	Infl_pm	Correlation Coefficient	.148	.169	-.002	.048	.112
		Sig. (2-tailed)	.309	.245	.987	.744	.443
		N	49	49	49	49	49
	wkrs_on_site	Correlation Coefficient	.149	.083	.140	.055	.158
		Sig. (2-tailed)	.324	.585	.354	.715	.293
		N	46	46	46	46	46
	Prior_cost	Correlation Coefficient	.004	-.046	-.259	-.020	-.201
		Sig. (2-tailed)	.980	.739	.059	.884	.144
		N	54	54	54	54	54
	Prior_time	Correlation Coefficient	-.183	.520**	.247	-.138	-.036
		Sig. (2-tailed)	.173	.000	.064	.305	.792
		N	57	57	57	57	57
	Prior_qual	Correlation Coefficient	.150	-.306*	.033	.187	.114
		Sig. (2-tailed)	.264	.021	.805	.164	.398
		N	57	57	57	57	57
	Prior_hands	Correlation Coefficient	.268*	.023	-.180	.162	-.039
		Sig. (2-tailed)	.043	.865	.180	.229	.772
		N	57	57	57	57	57
	Var	Correlation Coefficient	.087	.304*	.186	-.031	.149
		Sig. (2-tailed)	.521	.022	.166	.818	.269
		N	57	57	57	57	57

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Appendix O Scatterplots of the cultural dimensions and performance measures

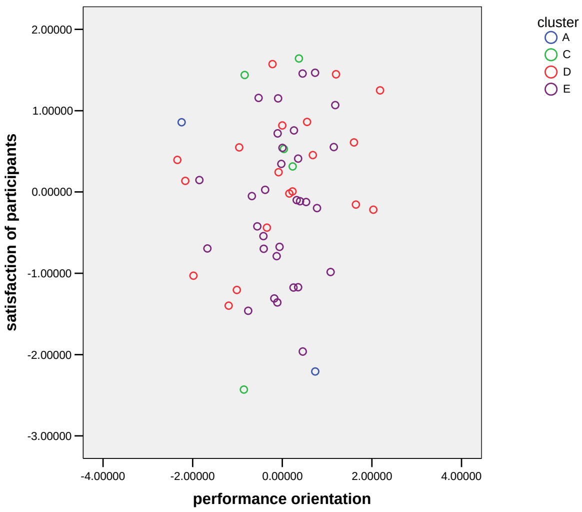

Figure 1 Scatterplot of participant satisfaction versus performance orientation

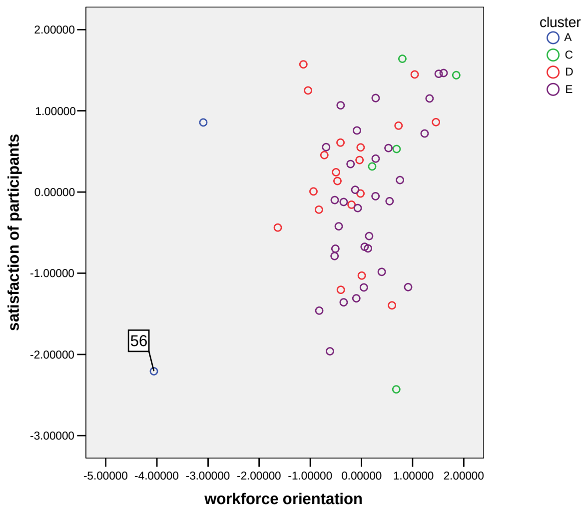

Figure 2 Scatterplot of participant satisfaction versus workforce orientation

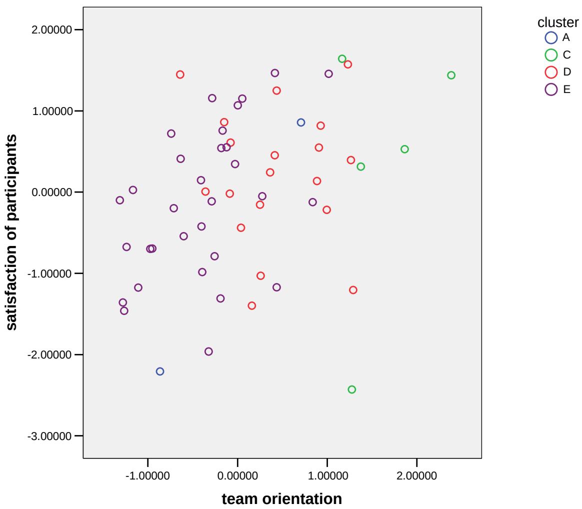

Figure 3 Scatterplot of participant satisfaction versus team orientation

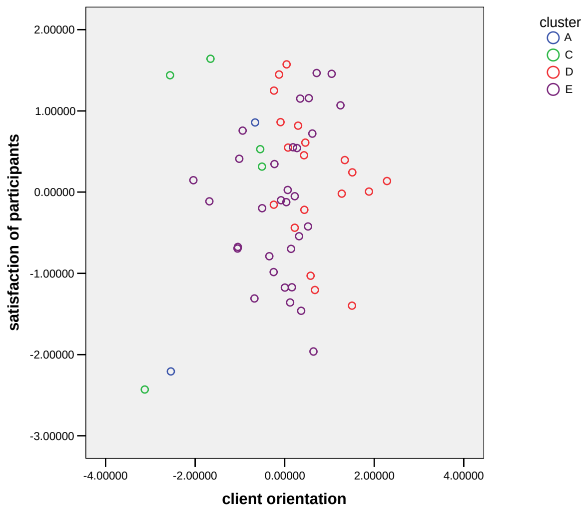

Figure 4 Scatterplot of participant satisfaction versus client orientation

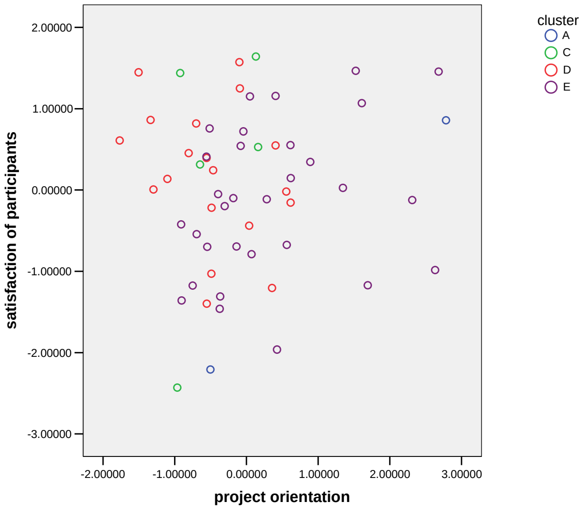

Figure 5 Scatterplot of participant satisfaction versus project orientation

Appendix P Results from the analysis of the hold-back data

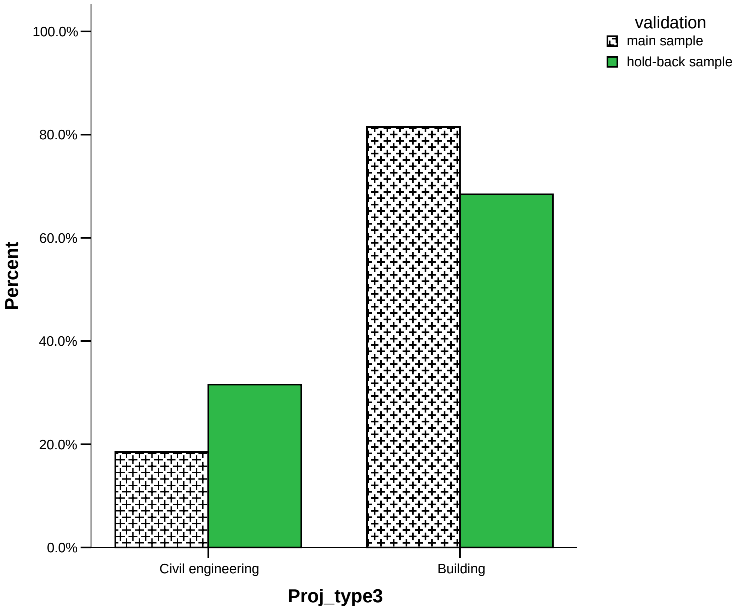

Figure 1 A comparison of projects by type of project

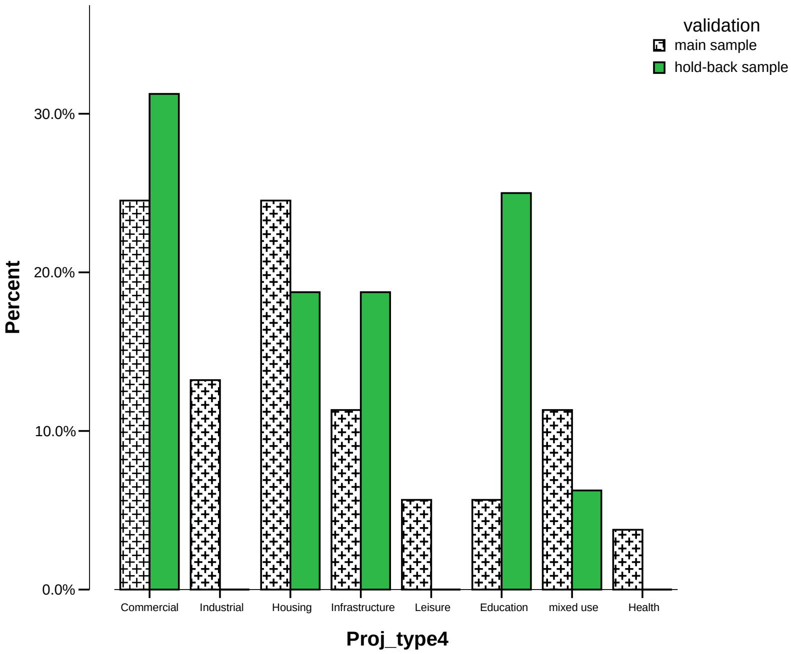

Figure 2 A comparison of projects by type of facility

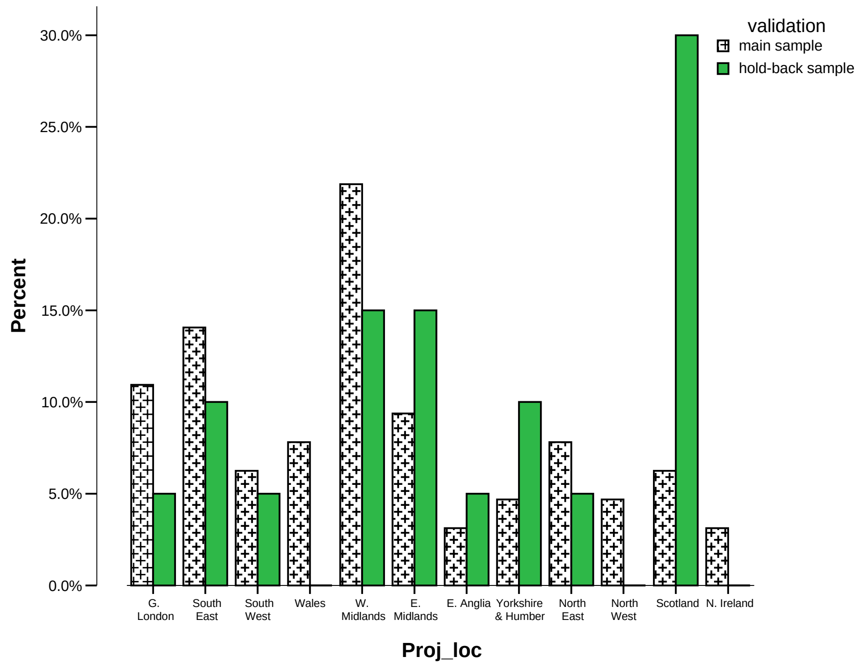

Figure 3 A comparison of projects by location

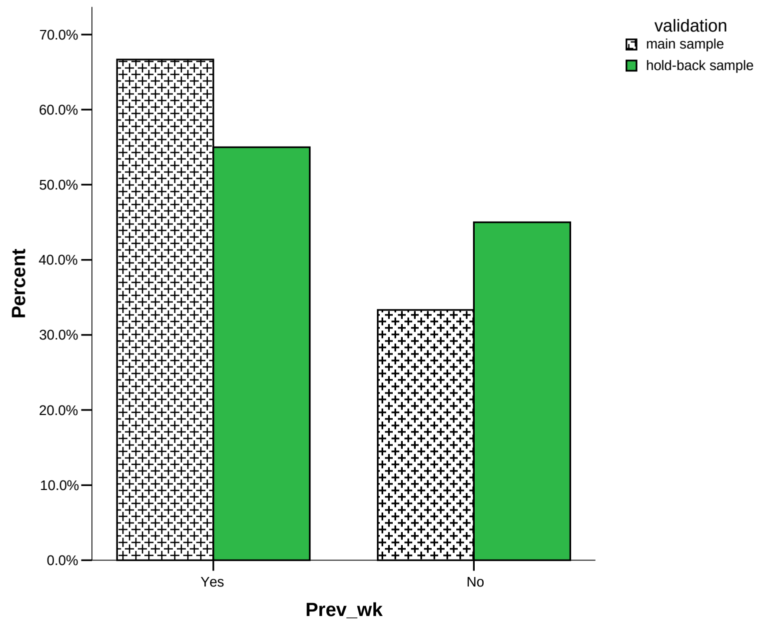

Figure 4 A comparison of projects on the variable 'previous work with client'

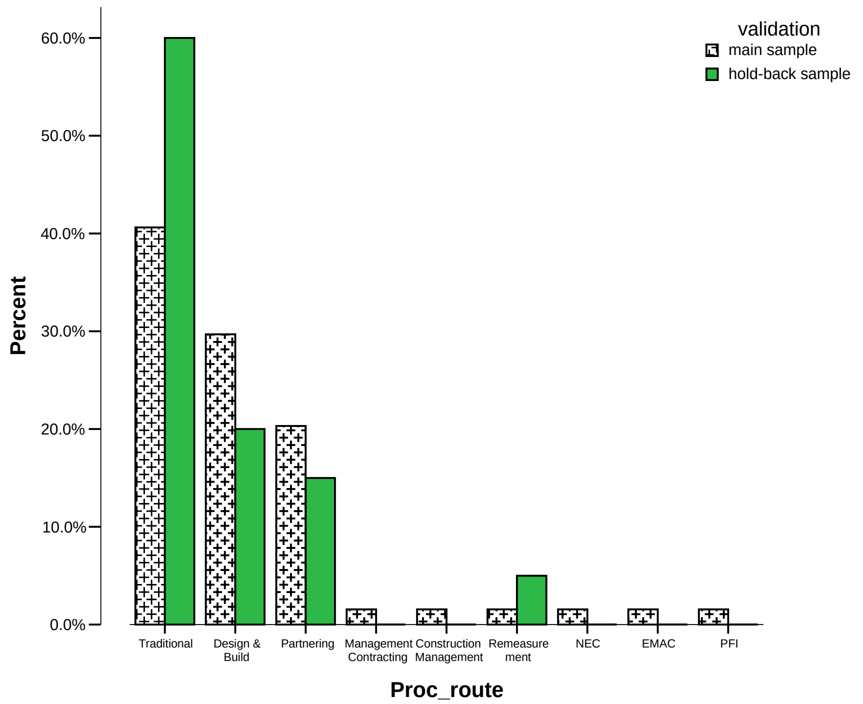

Figure 5 A comparison of projects by procurement route

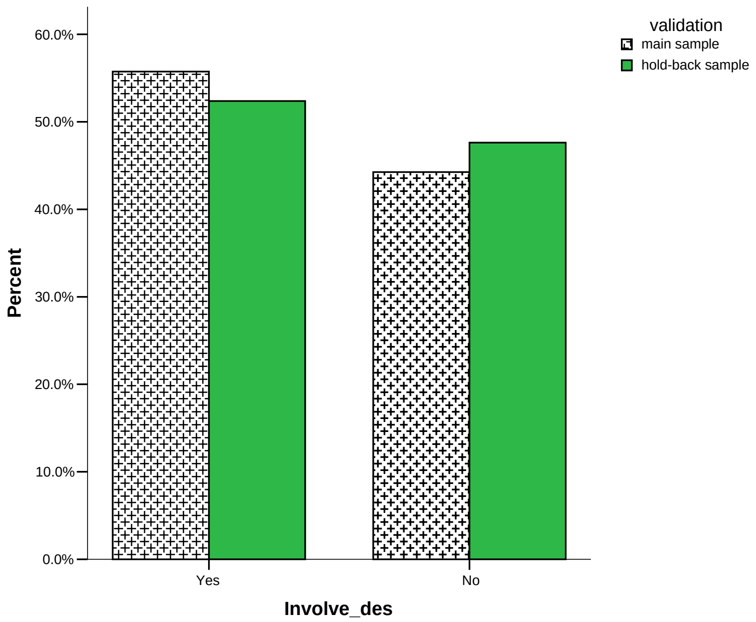

Figure 6 A comparison of projects on the variable 'involvement in design'

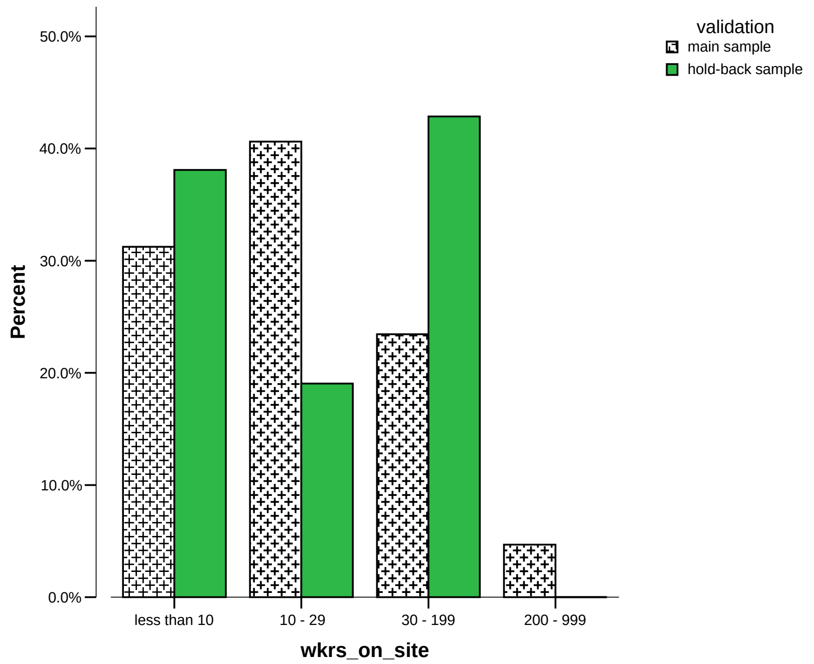

Figure 7 A comparison of projects by average number of workers on site

Table 1 A comparison of the cultural profiles (T1 – W8) of the samples: ANOVA results

		Sum of Squares	df	Mean Square	F	Sig.
T1	Between Groups	.327	1	.327	.876	.352
	Within Groups	31.040	83	.374		
	Total	31.367	84			
T2	Between Groups	.225	1	.225	.610	.437
	Within Groups	30.637	83	.369		
	Total	30.862	84			
T3	Between Groups	.116	1	.116	.271	.604
	Within Groups	35.619	83	.429		
	Total	35.735	84			
T4	Between Groups	.321	1	.321	.794	.376
	Within Groups	33.552	83	.404		
	Total	33.873	84			
T5	Between Groups	.247	1	.247	.653	.421
	Within Groups	31.391	83	.378		
	Total	31.638	84			
T6	Between Groups	.783	1	.783	2.176	.144
	Within Groups	29.858	83	.360		
	Total	30.641	84			
T7	Between Groups	.229	1	.229	.477	.492
	Within Groups	39.908	83	.481		
	Total	40.137	84			
T8	Between Groups	.117	1	.117	.263	.609
	Within Groups	36.890	83	.444		
	Total	37.007	84			
P1	Between Groups	.045	1	.045	.097	.756
	Within Groups	38.966	83	.469		
	Total	39.011	84			
P2	Between Groups	.053	1	.053	.152	.698

		Sum of Squares	df	Mean Square	F	Sig.
	Within Groups	29.047	83	.350		
	Total	29.100	84			
P3	Between Groups	.089	1	.089	.229	.633
	Within Groups	32.341	83	.390		
	Total	32.430	84			
P4	Between Groups	.084	1	.084	.193	.662
	Within Groups	36.315	83	.438		
	Total	36.399	84			
P5	Between Groups	.345	1	.345	.900	.346
	Within Groups	31.781	83	.383		
	Total	32.125	84			
P6	Between Groups	.027	1	.027	.074	.787
	Within Groups	30.183	83	.364		
	Total	30.210	84			
P7	Between Groups	.649	1	.649	1.863	.176
	Within Groups	28.916	83	.348		
	Total	29.565	84			
P8	Between Groups	1.078	1	1.078	2.837	.096
	Within Groups	31.521	83	.380		
	Total	32.599	84			
P9	Between Groups	.006	1	.006	.013	.909
	Within Groups	36.198	83	.436		
	Total	36.204	84			
W1	Between Groups	3.430	1	3.430	2.767	.100
	Within Groups	102.906	83	1.240		
	Total	106.337	84			
W2	Between Groups	.849	1	.849	2.288	.134
	Within Groups	30.781	83	.371		
	Total	31.629	84			
W3	Between Groups	.167	1	.167	.371	.544
	Within Groups	37.396	83	.451		
	Total	37.563	84			
W4	Between Groups	.158	1	.158	.452	.503
	Within Groups	28.969	83	.349		
	Total	29.127	84			
W5	Between Groups	1.186	1	1.186	1.900	.172
	Within Groups	51.797	83	.624		
	Total	52.983	84			
W6	Between Groups	.064	1	.064	.144	.705
	Within Groups	36.806	83	.443		
	Total	36.869	84			
W7	Between Groups	.004	1	.004	.009	.925
	Within Groups	40.050	83	.483		
	Total	40.055	84			
W8	Between Groups	.045	1	.045	.078	.780
	Within Groups	47.925	83	.577		
	Total	47.970	84			

Appendix Q Summary report sent to survey respondents

A REPORT ON AN INVESTIGATION INTO THE IMPACT OF CULTURE ON CONSTRUCTION PROJECT PERFORMANCE

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RESEARCH CONTEXT

For many year, government backed reports have continued to deplore the poor performance of the construction industry with many projects failing to exceed or live up to the expectations of clients. For improvement in project performance to be achieved, it is essential to investigate the factors that cause poor project performance. There is a common belief that the culture of the construction industry is one of the factors that has an impact on its performance. The culture of the construction industry at the project level is often associated with such attributes as fragmentation, antagonism, mistrust, poor communication, short-term mentality, blame culture, casual approaches to recruitment, machismo, and sexism. These attributes are in turn also associated with project outcomes like litigation, poor health and safety performance, inferior quality, and difficulties with the implementation of innovative philosophies and management approaches like TQM. Whilst such associations are helpful to the extent that they focus attention on the failings of the industry, and point to aspects that need to be improved, they are often arbitrary and often based on no more than anecdotal evidence, and as such do not provide a useful systematic basis for assessing the real impact of culture on performance. This research was thus undertaken to look for empirical evidence of a relationship between cultural orientations and project performance outcomes.

METHODOLOGY

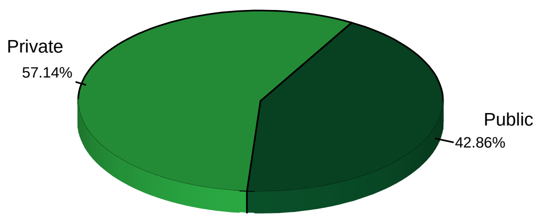
A questionnaire was developed to elicit information on the kinds of cultures that exist within construction project organisations as well as information on performance outcomes so that relationships between them can be explored using appropriate statistical techniques. A sample of Contractors drawn from the UK Kompass (2006) register was surveyed with this questionnaire.

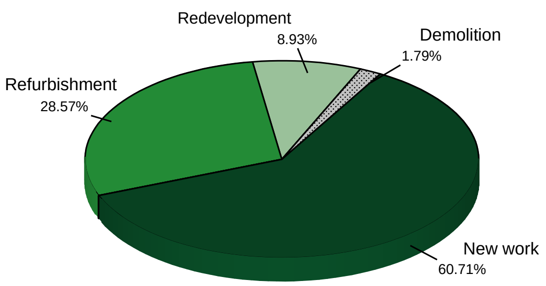
A total of 551 questionnaires were distributed out of which 85 were returned, representing a response rate of just over 15%. With samples of this size, results are accurate to within just over ±10%. 64 of these questionnaires were analysed to obtain the results reported in this document.

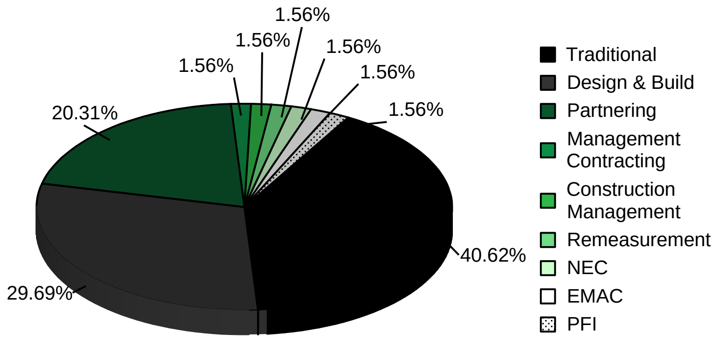
HEADLINE RESULTS

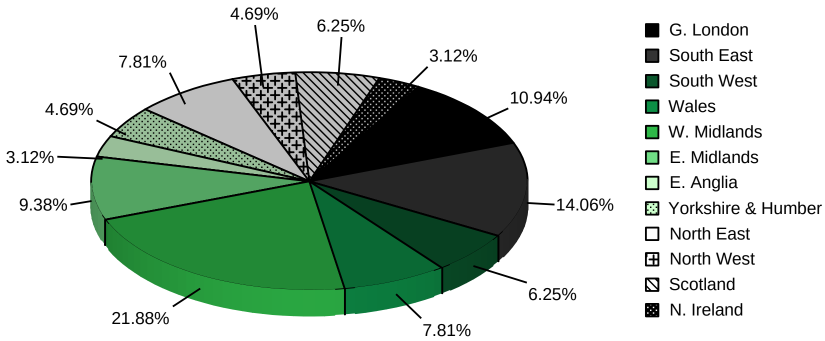
Project characteristics

The profile of projects in the sample is shown in the diagrams below.









The performance ethos of project organisations was found to be in the order health and safety (H&S) → quality → cost → time, with H&S as the most important and time as the least important.

Mean contract price was between £0.86M and £2.00M, with mean duration between 9 and 12 months. These results indicate that the projects sampled are generally representative of construction projects in the UK.

Performance levels

General performance levels of the projects in the sample for key measures are reported below.

- 58% of all projects were over budget, with an average overspend of about 1.7%.
- 41% of all projects were late.
- 75% of all projects had defects.

A cultural profile

Analysis revealed five principal dimensions of culture along which project organisations differ. These dimensions are *workforce orientation*, *performance orientation*, *team orientation*, *client orientation* and *project orientation*. These dimensions are defined as follows:

- Workforce orientation - Effort put into motivating workforce, extent of free and open communication, recognition of good performance, keeping operatives informed, extent of participation in planning and decision-making by the workforce, communication between managers and operatives.
- Performance orientation - Safeguarding H&S, providing performance feedback for continuous improvement, emphasising on-time delivery, and striving for quality & getting it right first time.
- Team orientation - Absence of blame culture, extent to which management is accessible and approachable, amount of information sharing, degree of trust, and avoidance of innovation.

- Client orientation - Effort put into educating client, extent to which client satisfaction is monitored, precedence of client's needs, and amount of contact & communication with the client.

- Project orientation - Extent to which participants identify with the project, the extent to which direct labour is used (as opposed to subcontracting), and effort put into waste elimination.

A performance profile

Analysis of performance measures revealed four principal performance measures of *participant satisfaction, H&S and quality outcomes, innovation and learning,* and *time and cost outcomes*. These performance measures are defined as follows:

- Participant satisfaction - This encompasses client satisfaction with *service*, *quality*, *cost* and *time*, management satisfaction with *project harmony* and *profitability*, and operative satisfaction with *conditions* and *wages*, as well as the absence of *claims*.

- H&S and quality outcomes - This relates to *accidents reported*, *injuries occuring*, *near misses reported*, *extent of defects*, and the *level of absenteeism* on the project.

- Innovation and learning - This encompasses the measures of *innovation*, *learning*, and *productivity*.

- Time and cost outcomes - This encompasses the measures of *time performance*, *claims*, and *cost performance*.

Relationship between culture and performance

Analysis of the data revealed a number of relationships between these cultural orientations and performance outcomes. The main findings are summarised below:

- Projects with higher *participant satisfaction* were those with higher *team* and *workforce orientations*;

- Projects with better *H&S and quality outcomes* were those with higher *project* and *team orientations*;

- Projects with higher levels of *innovation and learning* were those with higher *workforce orientation* but lower *team orientation*;

- None of the dimensions were associated with *time and cost outcomes* implying that factors other than the cultural dimensions influence performance;

- Projects with higher *overall performance* were those with higher *project* and *workforce orientations*; and lastly

- There is no evidence that the *client* or *performance orientations* influence performance outcomes.

CONCLUSION

These findings which are based on empirical evidence support the thesis that *culture does matter* in the quest for performance improvement. It is therefore recommended that project participants, and in particular Main Contractors, devote more effort and resources towards improving the orientations of their construction project organisations in respect of the dimensions of culture identified as having significant impacts on project performance outcomes, particularly *workforce orientation*, *team orientation* and *project orientation*.

PLEASE PROVIDE SOME COMMENTS ON THE VALIDITY OF THE RESEARCH FINDINGS

1. The research found that the projects with higher participant satisfaction were those with higher team and workforce orientations. From your experience, how valid is this finding?
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

2. The research found that the projects with better H&S and quality outcomes were those with higher project and team orientations. From your experience, how valid is this finding?
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

3. The research found that the projects with higher innovation and learning were those with higher workforce orientations. From your experience, how valid is this finding?
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

4. The research also found that the projects with higher innovation and learning were those with lower team orientations. From your experience, is this finding a valid reflection of what happens on construction projects?
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

5. The research found that none of the dimensions of culture were associated with time and cost outcomes. From your experience, is this finding a valid reflection of what happens on construction projects?
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

6. The research also found no evidence to link client and performance orientations with any of the performance outcomes. From your experience, how valid is this finding?
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

You are welcome to add any further thoughts you have on the validity and relevance of any of these findings

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General information

Please indicate your **Name** ……………………………………………………………………………

Please indicate your **Position** (Optional) ……………………………………………………………

How many **years of experience** do you have in construction? ………………………………………

Please return this form by fax, email or by post. Contact details are provided on the cover page. To discuss the findings reported, you may call 07957494817 or 01902323581.

Thank you for taking part in this research. If you wish to make any further contribution or would like to receive further information about the research, please feel free to contact the researcher.

Appendix R Results from respondent feedback

Question	Respondent	Response
The research found that the projects with higher participant satisfaction were those with higher team and workforce orientations. From your experience, how valid is this finding?	1	10/10
	2	Yes
	3	Agree
	4	Absolutely true – People need to be engaged with the project
	5	Reasonable. Lower team orientation is often linked to poor communication and information flow, and conflicts are also prolonged. Problems like these mean that satisfaction is diminished. I also think that team orientation will be the more important of the two.
The research found that the projects with better H&S and quality outcomes were those with higher project and team orientations. From your experience, how valid is this finding?	1	9/10
	2	Not necessarily, many small firms pride themselves on their quality but do not carry many staff
	3	Agree. However results might be skewed. This finding will probably only be true on larger projects
	4	It is valid
	5	True
The research found that the projects with higher innovation and learning were those with higher workforce orientations. From your experience, how valid is this finding?	1	9/10
	2	Yes
	3	Agree
	4	Agree
	5	Not sure. Not necessarily
The research also found that the projects with higher innovation and learning were those with lower team orientations. From your experience, is this finding a valid reflection of what happens on construction projects?	1	9/10
	2	Yes
	3	Surprising. One would have expected that innovation and learning would flourish on projects where there is a positive team environment
	4	
	5	Not sure, but possibly. Sometimes rewards associated with innovation breeds competition among participants which detracts from teamwork.
The research found that none of the dimensions of culture were associated with time and cost outcomes. From your experience, is this finding a valid reflection of what happens on construction projects?	1	7/10
	2	These items should be very high priority
	3	Not surprising. I consider issues like understanding the client's brief from the outset as some of the key determinants of time and cost outcomes
	4	I don't think so. I find that culture on a project changes and enthusiasm slips with delays

Question	Respondent	Response
	5	Would have thought it would have been related to project orientation
The research also found no evidence to link client and performance orientations with any of the performance outcomes. From your experience, how valid is this finding?	1	5/10
	2	True
	3	To some extent. For instance, some clients don't want to be involved and on such projects the level of client focus doesn't make any difference. On projects where clients are more hands-on, client focus is likely to have an influence on performance
	4	No. I find this hard to believe
	5	Agree with client orientation, but not performance orientation
You are welcome to add any further thoughts you have on the validity and relevance of any of these findings.	1	Interesting review
	2	Our comments can only relate to our company view which is not necessarily the views shared by others
	3	
	4	
	5	
General information		
Position	1	Director
	2	Managing Director
	3	Project mentor and facilitator
	4	Director
	5	QS
Years of experience	1	24
	2	29
	3	
	4	25
	5	4